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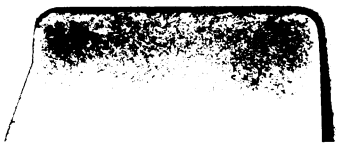

EARTHQUAKES

AND

VOLCANOES

65D

HOT SPRINGS

BY

PROF. J. F. WILSON, B. S. A. B.
GRANT UNIVERSITY
ATHENS, TENNESSEE

It contains 144 pages, 14 chapters, 18 fine half tone engravings, and is bound in two styles, viz:—1. Full black pebble cloth, and lettered back and front in gold—price $1.25—$12.00 per doz.

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PREFACE

In the preparation of this book we have no apologies to make. We feel that we have supplied a long felt want among the people. This treatise on earthquakes and volcanoes, can be used as well as a text-book in the school as in the family and the library. It can be successfully used alongside of geology, chemistry and physiology. The science of earthquakes and vulcanology has been growing rapidly during the last hundred years. Up to that time what few sketches that could be found at all, were mostly in a few foreign books and magazines. Even now, about all we see scientifically, is scattered through many magazines and costly encyclopedias that the average student or citizen never sees. This book brings the science within the reach of all. We have ignored all hard and meaningless words as far as possible and have used the simplest words so far as they would express the ideas to be conveyed. We never could see that anything is gained by using high-sounding words and phrases. We have given considerable space to the fearful earthquakes that recently destroyed San Francisco, Valparaiso, and Kingston, and also touched up Vesuvius a little, and a few other small affairs for the purpose of showing the course such events usually take, and also for the purpose of corroborating the indisputable fact that they were all only a series of terrestrial convulsions very closely connected. Such convulsions also lend abundant proof that the theory of gravitation is the proper solution of many perplexing questions, and answers every contingency in earthquakes and volcanoes.

With these remarks, this book is dedicated to the public, with the hope that it may be a blazing sun in the firmament of true science.

J. F. WILSON.

Knoxville, Tenn., October 10th, 1906.

A PROBLEM FOR THE SCIENTIST.

INTRODUCTION:

A New Theory Founded On Known Facts.

Earthquakes and volcanoes are among the most frequent and terrible phenomena which affect the physical condition of our globe.

Having seen so many and varied opinions and theories concerning the cause, the impression came upon me, that surely, with all our boasted learning, and all our recent discoveries in physical, electrical, magnetical and astronomical science, a correct theory could be established beyond a reasonable doubt. I am now writing thoroughly imbued with that impression. I will say, however, that I do not intend to leave God out of the creation as most scientists do. It simply remains for us to discover the laws by which He created the heavens and the earth, and the power by which He controls them in the hollow of His hand.

In Genesis, chapter 1, we read as follows: "In the beginning God created the heaven and the earth. And the earth was without form and void, and darkness was upon the face of the waters. And God said let there be light; and there was light. And God saw the light, that it was good: and God divided the light from the darkness. And God called the light Day, and the darkness He called Night. And the evening and the morning were the first day. And God said let there be a firmament in the midst of the waters, and let it divide the waters from the waters. And God said let the waters under the heaven be gathered together unto one place, and let the dry land appear: and it was so. And God called the dry land earth: and the gathering together of the waters, called He seas." Now, the Bible is either true or false. I will grant that the Bible is true. If the Bible is true, the Nebular Hypothesis, as promulgated by Gant and Laplace is false. Hence, all scientists writing from false premises will arrive at false conclusions. I think this is the reason why so many false

and exploded theories have been suggested. If the Bible is true, the earth was created before the sun or light, as given above. "Darkness was upon the face of the deep." "And the spirit of God moved upon the face of the waters." Then the earth was not a **ball** of **fire** as taught by the Nebular Hypothesis.

"And God said let there be light (a sun): and there was light" (a sun). Now, the above is sufficient to show upon what grounds a true theory must be established. And by taking the all-wise Creator into our counsels a true theory can be established beyond a reasonable doubt, concerning all the phenomena of earthquakes and volcanoes.

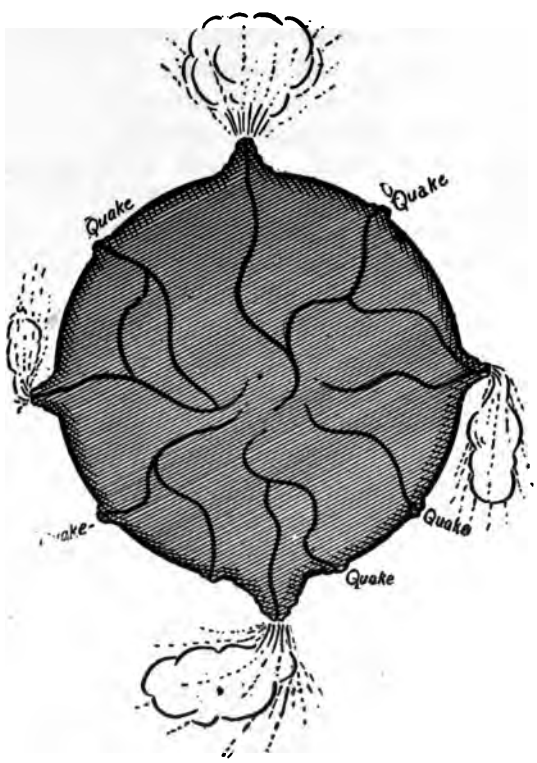

FIG. 2—Volcanic chart of the earth.

CHAPTER I.

HYPOTHESIS.

In order to a correct understanding of the true cause of earthquakes and volcanoes, it is necessary to call to our aid, three distinct sciences: namely, geography, geology and astronomy.

The real cause of all earthquakes and volcanoes hinges on Sir Isaac Newton's law of gravitation: "**Every particle of matter in the Universe attracts every other particle of matter with a Force Directly Proportional to its Quantity of matter, and Decreasing as the square of the Distance Increases.**"

The above law of universal gravitation is acknowledged and recognized to be correct by every reputable astronomer throughout the world. In fact, all the demonstrated truths in astronomy are based on this law. The thoroughly established truth of this law, is not, at this day, disputed by any one.

Upon this thoroughly established truth we shall frame a correct hypothesis which explains all the varied phenomena attendant upon earthquakes and volcanoes.

The reason why we treat both subjects together is, the cause which produces earthquakes, produces volcanoes also. We have never seen a single instance in which the cause which produces one, has been shown beyond a reasonable doubt, not to be able to produce the other. In fact, we consider it impossible to show that the cause which produces earthquakes, is not the same cause which produces volcanoes. Hence, we consider it highly proper to treat both subjects together, in order that a thoroughly satisfactory theory be established.

If then, every particle of matter in the earth is constantly attracting every other particle of matter, it follows, that the resultant force toward the center of the earth must of necessity create a tremendous pressure. No fact, in physical science is so well established, as that pressure produces heat. **Gravitation is the primal cause of all earthquakes and volcanoes.**

Geology teaches that heat increases as we descend toward the center of the earth at an average of about two degrees Fahrenheit for every hundred feet after the first hundred but of course this varies in different localities as is fully shown in mines, borings in deep artesian wells, and shafts sunken to great depths into the earth; but the increase toward the center is always apparent and constant as far as operations have been carried on. Hence, at this rate of increase, at or near the center of the earth, the heat would be so intense as to melt the hardest substance known, and hold it in a molten mass When this heat becomes so great and accumulates to such an extent in the interior of the earth, that the solid matter in the earth cannot endure it any longer it pushes up through the matter not so soft, and makes cracks or fissures in the outer crust by natural expansion and mixes with water and other gases that are ever present in the earth, and generates steam and other gases, which explodes with a tremendous force in what we call earthquakes and volcanoes. This confined power passes out by the way of least resistance, sometimes in submarine earthquakes and volcanoes and sometimes in different parts of the continents, generally along the sea coast in mountain ranges contiguous thereto. From this law of gravitation, heat is constantly accumulating in the interior of the earth, and must of necessity be relieved from time to time. Hence, there will be earthquakes and volcanoes as long as the earth remaineth. In earthquakes alone, when no volcano occurs the liquid fire-gas* and steam escape through fissures or softened earth in the crust, and sometimes at the bottom of the sea by loud rumbling noises not unlike distant thunder—sometimes like chains clanking together, and at other times like claps of keen thunder and broken glass.

Apply this law of gravitation to the moon as to the earth, and her volcanoes are readily understood. Apply this law to the sun as to the earth and moon, and the dark spots on the surface of the sun which have puzzled astronomers for centuries will readily be understood to be great cavities of volcanic power spurting up lava to the great distance of 80,000 miles, and falling back again upon his surface to be re-heated

*Electricity.

and shot forth again into space, radiating heat and light in all directions to the retinue of worlds in our solar system. Spectrum analysis has demonstrated beyond a doubt, that the sun and all the other planets are composed of the same constituent elements as the earth including the metals. Iron seems to be very abundant in the earth, moon and sun.

It takes 1,300,000 globes the size of the earth to equal the sun. Hence, to increase the size of the earth, to the size of the sun, and apply the law of gravitation as set out in this theory, and the earth would become a sun. Hence, whether the Nebular Hypothesis be correct or not, all God had to do was to throw enough matter together and form a sun by applying the law of gravitation which causes such a tremendous pressure on so large a mass of matter that it will forever remain a burning orb; or as long as God chooses to apply this law. Hence, the theory sometimes advanced that the sun will probably burn out is very erroneous: such theory must rest on the assumption that the sun is composed of combustible matter. The sun is composed of no more combustible matter than the earth or any other planet. This universal law of gravitation promulgated by Newton and not disputed by any one, is wonderful in the extreme when properly understood. In order that the Creator could carry out His design in creation He only had to put enough matter together to form planets. When He wished to make a solar system and a sun to control that system He only increased the mass of matter. Gravitation does the balance. False theories were taught in astronomy for 2,000 years. The correct theories were established and proven, by Corpernicus, Kepler, Galileo and Newton through much labor and difficulties. False theories are now being taught concerning earthquakes and volcanoes.

A committee appointed by the Governor of California to determine the cause of the earthquake that destroyed San Francisco, on April 18th, 1906, reported that it was caused by "stresses" in the earth's crust caused by settling. Another report from the recent earthquake that destroyed Socorro in New Mexico, says that the shocks were caused by slides of mountain masses in the Magdalena and Scorro ranges and that the temperature of hot springs has increased. Pray tell how the "slides" in the mountains could increase the temperature

of hot springs? The hot springs all over the world are the very best of evidence that the above theory of gravitation is correct and will finally be established. These hot springs come from very great depths in the earth where the heat is kept constant by pressure of the matter within the earth caused by gravitation. Another great proof is that Vesuvius has been active for 2,000 years with no signs of abatement. The opening in the crater probably extends to near or into the center of the earth about 4,000 miles where heat is kept constant by pressure from gravitation. Apply this law to all planets and where the mass of matter is sufficient earthquakes and volcanoes will follow.

This law also produces the light and heat of our sun. On the above principles this hypothesis stands or falls. We shall proceed now to a general discussion, showing many of the false and exploded theories, and many other matters pertaining to this subject which at the present time is so wonderfully misunderstood. By this treatise we hope to throw much light on the subject and establish as far as possible this theory of gravitation which, when properly understood, will better account for the phenomena of earthquakes and volcanoes than any other theory up to this time advanced. Now, we are cognizant of the fact that many other agencies enter into the phenomena of earthquakes and volcanoes; but they are only a production or creation of the force of gravity which we will be fully able to show. For instance: Steam, electricity, magnetism, and gases and molten matter are nothing but **creations** of the **power** of **gravity**. These forces, of course, obeying general laws, produce the results as seen; but these forces are as much the creations of the laws of gravity as earthquakes and volcanoes are the results of their actions.

"One God, one law, one element:
And one far-off Divine event,
To which the whole creation moves."

THE NEBULAR HYPOTHESIS

This is a theory which was advanced by Laplace to show how the solar system was formed. In the "beginning," all the matter which now composes the sun and the various planets,

with their moons, was in a gaseous and highly heated state. It filled all the space now occupied by the system, and extended far beyond the orbit of Neptune. In other words, the solar system was simply an immense nebula. The heat, which is the repellant force, overcame the attraction of gravitation. Gradually the mass cooled by radiation. As centuries passed, the repellant force becoming weaker, the attractive force drew the matter and condensed it toward one or more centers. The nebula then presented the appearance of a nebulous star—a nucleus enveloped to a great distance by a gaseous atmosphere. According to a well known law in philosophy, seen in everyday life, in a whirlpool, a whirlwind, or even in water poured into a funnel, wherever matter seeks a center, a rotary motion is established. As this rotary motion increased, the centrifugal force finally overcame at the exterior the attraction of gravitation, and so threw off a ring of condensed vapor. Centuries elapsed and again, under the same conditions, a second ring was detached. Thus one by one, concentric rings were separated from the parent nebula, all revolving in the same plane and in the same direction. These different rings, becoming gradually consolidated, formed the planets—generally, however, in this process, while still in the vaporous state and slowly condensing, themselves throwing off rings which were in turn consolidated into satellites. In the case of Saturn, several of these secondary rings did not break up, and so condense into globes, but still remain as rings which revolve about the planet. It is possible, under this theory that these rings may yet break up and form moons for that planet. Mitchell remarks that "Saturn's rings were left unfinished to show us how the world was made." The ring which formed the minor planets broke up into small fragments, none large enough to attract the rest and thus form a single globe. The central mass of vapor finally condensed itself into the sun, which remains the largest member of the system. According to this theory, the sun may yet give off a few more planets, whose orbits will not exceed its present diameter. After a time its heat will have all radiated into space, its fires will become extinct, and life on the planets will cease. Now, the above theory, called the "Nebular Hypothesis", is a very beautiful conception of how man might have made the universe in which is our present solar system.

And it is a very beautiful conception of how matter might have formed itself into suns and systems; but has blind matter this power? We have no evidence that it has. How do we know that in the "beginning" "all matter which now composes the sun and the various planets with their moons was in a highly heated state"? We have absolutely no evidence. How do we know, that the "Solar System" was an immense nebula? No evidence at all. How do we know that "after centuries these different rings formed themselves into planets"? No evidence at all. How do we know that the planets threw off their moons while in a vaporous state? No evidence at all. How do we know this central mass of vapor finally condensed itself into the sun? No evidence at all. How do we know that after a time its heat will have all been radiated into space, its fires will become extinct, and life on the planets will cease? **Not one iota of proof.** If we have not one syllable of proof to establish a theory, what right has that theory to recognition at all? Evidently it has no right. The Nebular Hypothesis stands in that predicament. It does not prove that in the "beginning" our solar system was intensely hot at all. It does not show why the planets revolve around the sun from West to East. It does not show why the axes of all the planets are set at certain angles in order to have a change of seasons as they go around the sun. It fails, absolutely, to even mention the comets—how they were formed or the cause of their revolving in all directions—East, West, North and South and between these points, and which sun it was that threw them off, our sun or some other sun. Any theory that fails at all these points is not worthy of recognition by any one. Now, if the Nebular Hypothesis has not furnished one syllable of evidence to show that its broad assumption is true, let us see if we can furnish the proof to show that it is false. If we cannot, we have no right to assail its teachings. Gen. 1: 1. "In the beginning God created the heaven and the earth." 2. "And the earth was without form and void; and darkness was upon the face of the deep. And the spirit of God moved upon the face of the waters." 3. "And God said, Let there be light (a sun), and there was light" (a sun). 4. "And God saw the light, that it was good. and God divided the light from the darkness." 5. "And God called the light day, and the darkness he called

night." "And the evening and the morning were the first day." How does this compare with the Nebular Hypothesis theory in regard to the formation of the world? The Nebular Hypothesis says, "All the Matter which now composes the sun and the various planets with their moons was in a highly heated state. It filled all the space now occupied by the system and extended far beyond the orbit of Neptune." Evidently the earth was created before the sun or the Bible is false. Which will we believe? The Bible says, "The spirit of God moved upon the face of the waters." The Nebular Hypothesis says, "The heat," which is the "repellant force," overcame the attraction of gravitation." "Gradually the mass cooled by radiation." The Bible says, Gen. 1: 16, "And God made two great lights; the greater light to rule the day, and the lesser light to rule the night: He made the stars also." 17—"And God set them in the firmament of the heaven to give light upon the earth." The Nebular Hypothesis says, "The central mass of vapor finally condensed itself into the sun." "After a time its heat will have all been radiated into space, its fire will become extinct, and life on the planets will cease." The Bible says, Gen. 8:22, "While the earth remaineth, seed time and harvest, and cold and heat and summer and winter, and day and night shall not cease." Assuming that the Bible is true, it is very evident that the Nebular Hypothesis is false. In holding up the Nebular Hypothesis in the light of the Bible, we will notice that they are at diagonals to each other. Nothing is plainer in the Bible than that the earth was created before the sun and that the earth was covered with water. Then it would have been utterly impossible for the earth to have been thrown off from the vaporous rings of a highly heated mass like the sun and retain its water at the same time; besides, we have abundant evidence and that evidence is being strengthened every day by excavations, borings and shafts sunken into the earth that it was at one time entirely covered with water. Sea shells and the bones of various water animals found all over the dry land and in the earth attest this fact beyond dispute. The oyster shells on top of the Rocky Mountains, 500 miles from any water at this day, establish this fact beyond question. But we need no further proof that the Nebular Hypothesis is false. What we wish to show is that almost every theory that attempts

to show the true cause of earthquakes and volcanoes bases its ideas on the Nebular Hypothesis; that is, that the earth was once a "ball of fire" thrown off from the sun and is cooling off and hence the heat in the interior of the earth that causes earthquakes and volcanoes has been there ever since it was thrown off from the sun. A more erroneous assumption could not be made. This is why a true theory has never been established. The universal law of gravitation, created by God himself, causes the sun and all the planets to revolve around each other, the greater always controlling the smaller. The law of gravitation applied to the earth produces a tremendous pressure toward the center and generates enough heat, gas and electricity to cause all the eruptions on the surface of the earth. Hence all phenomena of earthquakes and volcanoes are fully answered by the **Law of Gravitation.** Now, what the Law of Gravitation is, we do not pretend to say, except that it is God's invisible hand in everything.

CHAPTER II.

CAUSES OF VOLCANIC ACTION.

Every great scientific theory has been established by four processes: Observation, generalization, hypothesis and verification. Every completed scientific investigation must consist of these four operations.

1. Observation consists in collecting all the facts and experiments bearing on the question.

2. Generalization consists in classifying and grouping the isolated facts bearing one upon another, and the general conclusions to which they point.

3. Hypothesis is the foundation on which to base all the observed facts.

4. Verification is putting the hypothesis to the most rigid tests by comparing results which must follow.

The enquiry concerning the nature and causes of earthquakes and volcanoes is far from being a completed one. A complete and consistent theory of earthquakes and volcanoes remains to be established. Because of the fact that the Nebu-

lar Hypothesis has been generally received as probably correct, has led to many erroneous conclusions in other lines of investigation—especially concerning the phenomena of earthquakes and volcanoes. We do not believe that God in his infinite wisdom and power was put to such extremes as to have to create worlds and suns by the Nebular Hypothesis. It is not necessary for God to have to throw off all the planets including our earth from the sun in order to create a solar system. If He is indeed God in fact and in creation He is all powerful. If He is all powerful, His creative power is not limited by solar systems, but only by the universe. We must elevate ourselves, far above the little, narrow-minded, conceited and bigoted conceptions of the wisdom, power, and self-importance of man, if we ever hope to fathom the great depths of God's wisdom and power. God only had to let His spirit move upon the face of the deep, and the darkness fled away. He only had to use the word of His power, and continents and oceans began to move and take their proper places on the face of the earth. He only had to speak the word and all matter, gases and elements, would fly together and make worlds and suns and systems. This great Universal Law of Gravitation, was all the law He needed to create suns and systems. This great Universal Law of Gravitation is nothing more than God's power in controlling the universe. He had but one law. He needed but one law. He used but one law. That law when properly understood will satisfy all universal phenomena. If this is so, it certainly ought to fully satisfy all earthquake and volcanic activity.

No; the earth was not necessarily a "**ball of fire**" at its creation. The other seven planets, nor the sun was not necessarily a ball of fire when created. They could have been just as easy balls of matter lying in space dark and motionless till God, the Creator, moved upon them with His Universal Law of Gravitation and set them in motion as a clock and started them to rotating and revolving around each other, obeying this law in perfect harmony as long as He so designs. Let God, for one moment, suspend this law of gravitation, and suns and systems would plunge headlong into one chaotic abyss. This force of gravity, by its tremendous pressure, melts the sun, causing light and heat because of its great mass of matter, and causes the increase of heat toward the center of the earth in regular order,

and this same law would also melt the earth if the mass of matter was as large as the sun. Under the operation of this law it would be impossible to be otherwise. We can see, by the slightest reflection, that light and heat, and cold, and the changes of the seasons are constant. We have had a history of the sun for 6,000 years and its light and heat and attraction for the other planets are invariable and constant. It must of necessity obey some permanent law. The planets must obey some permanent unchanging law. They are as unchanging and permanent as God himself; for the universe is permeated by the power of God through His universal law of gravitation. But you say it is incomprehensible for you to conceive of such power; yes, and it is incomprehensible for you to conceive of the earth turning over at the rate of 1,000 miles per hour at the equator, on its axis, and flying through space on its journey around the sun at the rate of 19 miles a second; but it is nevertheless so.

It does seem, that after entering into the true spirit of God's creative power, and the grandeur He displays in controlling all His created things, that surely we ought to be able to comprehend His wonderful power He displays in earthquakes and volcanoes by the law of gravitation.

In the following pages we shall see how far the actual observations and experiments and the knowledge of known facts go to establish this theory. We shall always consider the earth a planet, and a magnet; and composed of the same kind of matter as the other parts of the solar system including the sun. Gravitation acting upon matter produces heat and light. Heat by expansion of molecules and atoms produces friction and pressure. Pressure generates heat. Heat produces electricity. Electricity produces magnetism. So, you see gravitation produces heat, electricity and magnetism. Let us see if they have any other kindred relations. Gravitation decreases in attraction by the square of the distance. Light decreases in intensity by the square of the distance. The shock of an earthquake decreases from its center as the square of the distance. So you see there is a very close relation. They are really all the manifestation of one universal law—**Gravitation.**

The sources of electricity may be divided into three classes: Mechanical, Physical and Chemical.

1. The Mechanical sources are: friction, pressure, and separation of molecules of bodies.

2. The Physical sources are variation of temperature.

3. The Chemical sources are chemical compositions and decompositions of bodies.

Metals, like zinc, iron and copper, when plunged into acids, are attacked by them forming compounds known as salts. During these combinations considerable quantities of electricity are developed. The most powerful causes of electricity are **friction** and **chemical action.**

The above fundamental laws are laid down at the beginning, because we wish to refer to them later on to show that the behavior of earthquakes and volcanoes correspond exactly to the development of these forces. We wish it distinctly understood that we do not admit that the earth was ever a **ball** of **fire** as indicated by the Nebular Hypothesis; but that it was probably in a soft or gaseous state when rolled forth from the hand of God, and all the changes in form, shape or physical condition, and all the heat it has ever had or radiated into space has been produced by the **law** of **gravitation.** And that the earth and moon and sun and all the other planets of our solar system, are not losing their energy, power and vitality and growing old as some would teach; but that they are young, vigorous and energetic, fully competent to live on and on through the ages, discharging their functions indefinitely under the Divine guidance of their Creator.

To consider them in any other light is to discredit God's eternity and to limit His eternal power! Let us, in the first place, see what are the facts to be accounted for in any theory of earthquake and volcanic action. We have already been led to the conclusion that the phenomena produced by earthquakes and volcanoes were caused by the escape of imprisoned water and other gases from masses of incandescent and fluid rock. All subsequent manifestations of earthquakes and volcanoes, confirmed the conclusion, that in all cases of volcanic outbursts we have molten rock materials from which water, steam, and other gases escape with more or less violence. The two great facts then to be accounted for in any explanation of earthquake and volcanic phenomena, are the existence of this high temperature within the earth's crust, and the presence of great quanti-

ties of water, gases and other ingredients imprisoned in the rocks. That a high temperature exists in the earth's crust at a certain depth from the surface, is a fact that does not admit of any doubt. Every shaft sunk for mining purposes, and every deep boring for the purpose of obtaining water attests the fact that a more or less regular increase of temperature takes place as we descend.

TEMPERATURE OF THE EARTH.

The average rate of increase of temperature in the earth as we descend downward is estimated to be about 1 degree Fah. for every 50 or 60 feet of depth. Now, if this regular increase of temperature continues to great depths, a simple calculation proves that at a depth of 9,000 feet a temperature of 212 degrees Fah. will be found—a heat sufficient to boil water at the earth's surface, while at a depth of 28 miles the temperature will be high enough to melt cast iron, and at 34 miles downward hot enough to fuse platinum. So marked is this steady increase of temperature as we go downward that it has been seriously proposed to make very deep borings in order to obtain supplies of hot water for heating our towns, or generating sufficient steam to propel machinery for manufacturing purposes. And now that such important improvements have been made in carrying borings to such great depths, the time may not be far distant when we shall draw extensively upon these supplies of subterranean heat. At the present time the city of Buda-Pesth is extensively supplied with hot water from a great depth. Should our coal supply ever fail it may be well to remember that we have these inexhaustible supplies of heat everywhere beneath our feet. But if the Nebular Hypothesis be correct and the earth was once a ball of fire thrown off into space, and that the earth is constantly cooling off and wrinkling as in old age, it would not be very safe nor wise to make very large investments in machinery nor manufacturing establishments as this supply of internal heat would finally be exhausted. But this Nebular Hypothesis is not correct and we need have no fears that the internal heat will ever be exhausted while God allows the law of gravitation to draw every particle of matter within the earth toward the center, thus causing such a tremendous

pressure that heat is constantly accumulating within the earth. Thus you see the absurdity of such conclusions. But although we have positively shown, that at the moderate depths of 9,000 feet, 28 miles and 34 miles that a very high temperature exists, some have concluded that it is not safe to infer that at a distance of 40 or 50 miles from the surface the materials composing our globe are in a state of actual fusion. Why such doubt should be entertained we fail fully to understand. Some teach that pressure can become so intense as to cause matter to go beyond the point of fusion. They claim that the rock material within the earth can become so hot as to assume a state they call by the incomprehensible term of "potentially liquid condition." Now, Webster says "potential" means "existing in possibility, not in actuality." Then a "potential liquid condition" exists in "possibility, not in actuality." Now, what kind of a condition is this, anyway? Of course none at all—does not exist in actuality at all. Hence, a false assumption. Now, why not come to a sensible and reasonable conclusion, and say once and for all, that heat increases regularly as you descend into the interior of the earth and at a considerable depth the heat must be very intense with a strong probability that the interior of the earth is a molten mass? Now, it is not even necessary to establish the point, that the interior of the earth is a molten mass, in order to establish beyond a doubt that the phenomena of earthquakes and volcanoes is actually caused by gravitation. It is believed by many, and on good grounds, that the origin of earthquakes and volcanoes is at a distance from the earth's surface, in some instances, of not more than 30 miles; and even less—not more than 8 miles in some cases. Be that as it may, it disproves nothing in regard to the real cause—gravitation; for, as we descend into the earth we must remember that at a distance of 30 miles we have left a considerable amount of matter behind us and that its attractive force upward would greatly minimize the attractive force downward and would cause a considerable decrease in the rate of heat at the center of the earth. For instance: suppose we make a hole through the earth, 8,000 miles. At the earth's center, 4,000 miles, a cannon ball dropped into this hole would come to a rest. The speed of this ball would be decreased continually after it descended far enough

into the earth, that the matter left behind it would be a retarding force by the attraction of gravitation. This ball would not stop, however, when it reached the center; but would go beyond and oscillate across the center backward and forward by the power of momentum, till it finally comes to a rest. If the rapid rate of increase in temperature which has been demonstrated to occur at so many parts of the earth's surface be maintained to its center, then it is very difficult to conceive of our earth as being in any other condition than that of a liquid mass at its center covered by an outward crust. But to say that the liquid mass at the center of the earth is covered by a thin outer shell, as taught by some geologists, is far from the proper conception of its condition. From the law of gravitation which presses every particle of matter toward the center of the earth, the temperature would increase gradually and regularly downward, so that at some points, the heat would be just comfortably warm and a little lower down a little hotter, and a little lower down still a little hotter till it would reach a temperature about like a glowing coal, and still be solid; and still downward we go till we reach melted rock, then fluid rock, then sparkling, scintillating matter hotter than anything with which we can compare it at the surface of the earth. Of course, this increase of temperature would vary in different parts of the earth as it was affected by many surrounding conditions which we think would be a natural consequence if it had not been demonstrated by positive experiments. For instance: we would pass by large lakes and possible cold currents of water. We would pass by close to the bottom of the ocean which is at a temperature a little above the freezing point, we would pass through strata not subject to retain the same amount of heat as other strata of rock. We would pass by great caverns filled with various gases and air. We would pass by columns of melted lava lying dormant in great lakes, only waiting for some disturbance, by water, air, gases or electricity, or some magnetical influence caused by the approach of the sun or moon. We will say this is to be expected from a common sense standpoint and from what we know concerning the elements that enter into the make-up of our earth. The surprise to me is, that anyone should be astonished to find these conditions existing in the interior of the earth. This is nothing more

than what must be, if the theory of gravitation is correct. And it is no more than what could not be if the nebular hypothesis be correct. I suppose this is the reason why all the writings and books treating on earthquakes and volcanoes do not teach anything for certain. Any one who will take the pains to peruse these pages will see that this volume teaches something for certain; and that is, that there is no other way to explain earthquake and volcanic phenomena except through the law of gravitation. You must remember that we are always 4,000 miles from the center of the earth. We can have 3,000 miles on this side of the center and 3,000 miles on the other side of the center and 1,000 miles of crust of the earth on the outside of all this and have 6,000 miles of a liquid sea of fire in the interior. Is it any wonder we have earthquakes and volcanoes? M. Walferdin, by a series of careful observations in two shafts at Creuszot, France, proved that down to the depth of 1,800 feet the increase of temperature was 1 degree Fah. for every 55 feet of descent; but below the 1,800 feet, the rate of increase was much as 1 degree Fah. for every 44 feet. On the other hand, in the great boring of Grenelle at Paris, the increase of temperature down to the depth of 740 feet was 1 degree Fah. for every 50 feet of descent; but from 740 feet down to 1,600 feet, the rate of increase diminished to 1 degree for every 75 feet of descent. The same expected and natural fact is shown in the case of the second deepest boring in the world, at Sperenberg near Berlin, which attained the great depth of 4,052 feet. In this case, the rate of increase in temperature for the first 1,900 feet was 1 degree Fah. for every 55 feet of descent, and for the next 2,000 feet, it diminished to 1 degree Fah. for every 62 feet of descent. In the deep well of Buda-Pesth there was actually found a decline in temperature below 3,000 feet. In districts which have recently been the center of volcanic agencies, the rate of increase in temperature as we go downward in the earth, is abnormally high. Thus at Monte Massi in Tuscany, the temperature was found to increase at the rate of 1 degree Fah. for every 24 feet of descent. In Hungary several deep wells and borings have been made which prove that a very rapid rate of increase of temperature occurs. The deep boring at Buda-Pesth penetrates to a depth of 3,160 feet and a temperature of 178 degrees Fah.

has been observed near the bottom. The rate of increase in this boring was about 1 degree for every 23 feet of descent. In the mines opened in the great Comstock lode in Nevada in the United States an abnormally high temperature has been met with, amounting to 157 degrees Fah. in some cases. Although this is the richest mineral vein in the world in the production of gold and silver, the rapid increase in temperature in going downward is such as to threaten the closing of the mines. The rate of increase of temperature in the Comstock mines has been estimated at 1 degree Fah. for every 45 feet of descent between 1,000 and 2,000 feet from the surface; but as much as 1 degree Fah. for every 25 feet at depths below 2,000 feet. These facts which we have stated have caused geologists to doubt the hypothesis of an incandescent nucleus of liquid matter at the center of the earth. They have thus been led to enquire whether there are any conceivable sources of high temperatures at moderate depths—temperatures which would be quite competent to produce locally all the phenomena of earthquake and volcanic action. By the Nebular Hypothesis, and the cooling off process and by the supposed chemical action taking place in the interior of the earth, we have been led to form many erroneous theories concerning earthquakes and volcanoes. The close connection between earthquakes and volcanoes cannot be doubted. That they are produced by the same cause is very evident. That neither can occur until the pressure from gravitation has produced heat enough to generate the explosive power, by infiltration of water, gases, electricity or magnetic power, is certain. So it seems fruitless to search further for a true theory with such facts before our eyes; but the inquisitive mind of man is never satisfied. Some ask the question why the earth rotates from West to East? If it turned from East to West, they would no doubt ask why it did not turn from West to East? We consider that we have made a strong presentation of our case so far; but we shall now bring forward the indisputable evidence which will more clearly establish our position. It matters not whether the seat of volcanic disturbance is near the surface of the earth, or far down in the interior. It matters not whether it is 30 or 300 miles; whether it is 300 or 3,000 miles from the surface of the earth, there is not a case which gravitation will not answer.

There is one circumstance that will forever refute the Nebular Hypothesis and the cooling-off process of the earth. If the earth is cooling off, why do these lakes of liquid fire remain dormant in the earth 6,000 years and then all of a sudden burst forth with such wonderful fury as to sweep everything before them? If the earth is cooling off, why has Vesuvius not cooled off a little in the last 2,000 years? If the earth is cooling off, why do 407 vents scattered all over the world spurt liquid fire from so many volcanoes? If the earth is cooling off, why do 30,000 earthquakes occur every year, 60 of which shake the entire world? The answer is, this cooling-off process will not satisfy the question. It was not known until recent years that so many earthquakes occurred. The recent inventions of the Seismograph, Magnetograph and Electrograph, have caused many records to be made of terrestrial disturbances that were unthought of before; the recent discovery of frictional electricity and the application to motor-cars, and the recent discovery of wireless telegraphy, have opened up new fields of thought and forced all scientific men to consider the earth nothing but a planet and a magnet and a very small one at that, and controlled by the same laws as all the other members of our solar system. The number of volcanoes on the earth now, is estimated to be 407. The number of earthquakes that have occurred is unknown and unknowable, since the earth was created. As now recorded by the seismograph, about 30,000 earthquakes occur annually. A simple calculation for 6,000 years, since we have known the earth, would reach the enormous number of 180,000,000 earthquake disturbances. Of course most of these are of minor importance. The number of the world's greatest earthquakes, causing an immense amount of loss of life and property is estimated to be about 75 since A. D. 79. Thus we see that a very few are destructive compared to the great number that occur every year.

GOD

"Warms in the sun, refreshes in the breeze;
Glows in the stars, and blossoms in the trees.
Lives through all life, extends through all extent,
Spreads, undivided, operates unspent."

CHAPTER III.

THE EARTH AS A MEMBER OF THE SOLAR SYSTEM. AN EXTRACT.

"But if we are constrained to admit that a study of the phenomena and established laws of volcanic activity have not as yet enabled us to prove any complete and satisfactory theory on the subject, we cannot lose sight of the fact that all modern speculation upon this question appears to be tending in one definite direction. It is every day becoming more and more clear that our earth is bound by ties of the closest resemblance to the other members of that family of worlds to which it belongs, and that the materials entering into their construction, and the forces operating in all are the same. We have had occasion in a previous chapter to point out that there are the strongest grounds for believing the interior of our globe to consist of similar materials to those found in the small planetary bodies known as meteorites. That the comets are merely aggregations of such meteorites, and that the planets differ from them only in their greater dimensions, may be regarded as among the demonstrated conclusions of astronomy. The materials found most abundantly in meteorites and in the interior of our globe are precisely the same as those which are proved to exist in an incandescent state in our sun. Hence, we are led to conclude that the whole of the bodies of the solar system are composed of the same chemical elements. That the forces operating in each of these distant bodies presents striking points of analogy is equally clear. The sun is of far greater dimensions than our earth, and is still in great part, if not entirely, in a gaseous condition. The great movements in the outer envelopes of the sun exhibited in 'sun-spots' and 'solar prominences' recall to the mind the phenomena of volcanic activity upon our globe. But the vast energy still existing in the intensely heated mass of the sun, and the wonderful mobility of its gaseous materials, give rise to appearances beside which all terrestrial outbursts seem to sink into utter insignificance. Vast cavities of such dimensions that many globes the size of our earth might be swallowed up in then

are formed in the solar envelopes in the course of a few days or hours. Within these cavities or 'sun-spots' incandescent vapors are observed rushing upwards and downwards with almost inconveivable velocity. In Fig. 89 a group of sun-spots is represented, and in their circular outlines and tendency to a linear arrangement, they can scarcely fail to remind anyone familiar with volcanic phenomena of terrestrial craters, though their dimensions are so much greater. In Fig. 90 the sun-spots represented show the presence of large floating masses of incandescent materials rushing upwards and downwards within the yawning gulf."

"The so-called solar prominences present even more striking resemblances to the volcanic outbursts of our globe. Even still more striking are the changes recorded by Prof. Young, of New Haven, in a solar prominence which he observed on September 7th, 1871. That astronomer described a mass of incandescent gas rising from the surface of the sun, to the height of 54,000 miles. In less than 25 minutes he saw the whole mass torn to shreds and blown upwards, some of the fragments being in ten minutes hurled to the height of 200,000 miles above the sun's surface. The masses of incandescent gas thus hurled upwards were of enormous dimensions, the smallest being estimated as having a greater area than the whole of the British Isles, and the velocity acquired was 166 miles per second."

Now, we quote the above article from Mr. Judd, in order to show that so distinguished a scientist had observed the great indisputable similarity between the actions of the sun and the earth; and yet he did not offer any explanation of such great similarity. This article was written 25 years ago, and if we look beneath the surface we will be able to see why he did not. He says, "The sun is of far greater dimensions than our earth, and is still in great part, if not entirely in a gaseous condition." "And is still in great part, if not entirely, in a gaseous condition:" This shows how his judgment and common sense had been warped by the Nebular Hypothesis—as much as to say that the sun is waning or burning out or cooling off. "But the vast energy still existing in the intensely heated mass of the sun," etc., shows plainly that he considers the sun as losing some of its energy, cooling off or burning

out—when we have had a history of the sun for 6,000 years and there is not one scintilla of evidence in history or tradition to show that it has lost one particle of light, heat or energy! Had he been able to see and comprehend the full working power of gravitation on matter, he could have formed a beautiful, systematic, and consistent theory, to account for all these phenomena. Not only in the sun, but in the earthquake and volcanic activity of our globe.

THE MOON

As our neighbor, the moon has been convulsed by many volcanoes and no doubt moonquakes, and as she is a member of the family of worlds to which our earth belongs, it is proper and right to bring her into this discussion as she comes under the same laws of gravitation as our earth. The moon's average distance from the earth is 238,000 miles. It would require a chain of 30 globes the size of the earth to reach the moon. Its diameter is 2,160 miles. It would require 50 globes the size of the moon to equal the earth. As the moon rotates on its axis in the same time it revolves around the earth, the same side is turned toward us all the time. Its circumference is about 6,480 miles, or one-fourth that of the earth. It rotates on its axis in 27 days 7 hours and 43 minutes. It weighs 78 quintillion tons, and flies through space at the rate of 2,273 miles per hour. It has no light of its own. It only gives reflected light from the sun. It has no heat of its own, except what is imparted to it in its interior by pressure from the law of gravitation. This pressure has been sufficient to generate enough heat, electricity, magnetism and gases in its interior as to cause it to be greatly disturbed by volcanoes and no doubt moonquakes in the past. The supposition that volcanic action in the moon had ceased, has been contradicted by many astronomers in recent years. Many changes have taken place lately in what had been supposed to be extinct volcanoes. The craters being broken down and otherwise greatly changed. Moonquakes and volcanoes will not cease in the moon until the law of gravitation is suspended. We have at least two instances in which the law of gravitation was suspended; and one in which the earth was turned backward. Remember, I am writ-

ing on the theory that the Bible is true, and that God is all powerful. I think to write with any other conception is to make ourselves a fool.

THE SUN STOOD STILL.

Joshua 10:12, 13, 14.

"12. Then spake Joshua to the Lord in the day when the Lord delivered up the Amorites before the children of Israel, and he said in the sight of Israel, Sun stand thou still upon Gibeon; and thou, moon, in the valley of Ajalon.

"13. And the sun stood still, and the moon stayed, until the people had avenged themselves upon their enemies. Is not this written in the book of Jashur? The sun stood still in the midst of heaven, and hasted not to go down about a whole day.

"14. And there was no day like that before it or after it, that the Lord hearkened unto the voice of a man: for the Lord fought for Israel."

And 915 years afterward, Habakkuk, 3: 11, testified that it did occur. "The sun and moon stood still in their habitation."

THE EARTH TURNED BACKWARD.

II Kings, 20: 11.

Hezekiah, having received a message of death, by prayer has his life lengthened. The earth turned ten degrees backward for a sign of that promise.

"And Isaiah, the prophet, cried unto the Lord: and he brought the shadow ten degrees backward, by which it had gone down in the dial of Ahaz."

Now, if we are not convinced by what has gone before, that God can, and did suspend the law of gravitation and that the sun and moon did stand still, and that the earth did actually turn backward, we do nothing less than dispute the Bible and place our feet on the rotten foundation of infidelity. No other truthful conclusion can be reached.

So, now we are prepared to fully understand the universal law of gravitation, and that it is God's way of controlling, not only the earth, but the universe.

Then, is it any surprise that God should use this same law by which the universe revolves, to control the actions of earthquakes and volcanoes? Any sensible or rational answer would be no. Gravity by its force of action on the earth has a specific tendency to press all the matter in the earth toward the center; by this tremendous pressure toward the center sufficient heat, electricity, magnetism and gases are produced in the interior of the earth, by **friction** and chemical changes to cause an explosion and consequent phenomena of all earthquakes and volcanoes. Reasoning from analogy, it is perfectly consistent to consider the interior of the earth in the same condition as the sun. Of course, the confined mass of molten matter mixed with gaseous elements could not be expected to be quiet. Hence, we have from 20 to 50 earthquakes every day as recorded by the seismograph. Of course, a liquid sea of fire at least 6,000 miles in diameter, mixed with water, gases, electricity and magnetism, would be anything but tranquil.

Gases, electricity, and magnetism are nothing more than the agents in the hands of gravitation, and each must be accounted for by rules and regulations governing the expansions or contractions of such gaseous elements. For instance, steam may be called water-gas. Electricity may be called fire-gas,* and magnetism is a production of this fire-gas operating on metallic substances. We shall proceed henceforward to give the actual occurrences of earthquakes and volcanoes as they appear upon the earth and the laws bearing on each individual case.

*A new word.

CHAPTER IV.

OUR NEW ISLAND IN POLAR SEA.

In order that we may more fully understand the seismic disturbances that have devastated the western coast of North and South Americas during the present year, beginning in April, 1906, we will begin at our new island in the Polar Sea.

Press dispatch: Tacoma, Wash., Aug. 9.—"Captain Truebridge, of the steamship Northwestern, to-day displayed a photograph that he brought from the North, taken by an officer of the revenue cutter Perry, of a newly formed island lying 50 miles west of Dutch Harbor, directly between the Bogoslov islands, commonly known as Castle and Fire Islands. The new island made its first appearance during June, and is now 600 feet high. The length could not be ascertained as the Perry could not get close enough to make an accurate measurement. Clouds of steam rise from its summit, and it is surrounded by boiling water."

From The Literary Digest: "The Pacific Coast of the two Americas, always a line of disturbance in the earth's crust, is certainly making a record for itself this year. The unusually violent earthquake in California and Chili are but the culminating points of a series of minor disturbances, and farther north we have evidence that volcanic activity has not yet entirely ceased in the vicinity of Alaska, where it has been conspicuous in the past. Within the past few weeks we have the news that a steaming mass of rock has emerged from Behring Sea and risen to the height of 600 feet, adding another unit to our insular possessions." Says an editorial writer in the New York Tribune, Aug. 12, commenting on this event: "There are at least two well-remembered precedents for the incident which is now reported from Alaska. One of the Bogoslov islands, which lies about forty miles to the westward of Uniak, began to develop in 1795, though it was not distinctly recognized until the following year. It is not unlikely that the operation of lifting it up from the shallow sea extended through a period of several months. The second islet of the

Bogoslov group made its advent in 1883, and at the same time a volcano in Cook's Inlet, (St. Augustine), emitted fire and dust, and was subjected to earthquake shudders. The distance between the two centers of disturbance is greater than the interval which separates Martinique and St. Vincent; but like Pelee and La Souffriere, the new Bogoslov and St. Augustine may have been situated along the same 'fault' in the earth's crust. The unnamed islet which discovery has just been announced lies 155 miles to the northwest of Unalaska, and may bear the same relation to the volcanoes of that island, inasmuch as these seem to have undergone no notable change of late. However, it is possible that the stresses which gave rise to the recent modest upheaval affected only a limited area. Both Unalaska and Unimak experienced what might be called 'sympathetic strikes' when the first of the Bogoslovs was formed." Alaska and vicinity, we are reminded, have afforded exceptionally fine opportunities for the study of volcanic phenomena. Frequent raised beaches testify to attractions of level in the past, and occasions like the present enable us to witness the effect of more recent subterranean activity. To quote further: "In 1884, the year after the second Bogoslov rose from the sea, it was still possible to see and photograph the enormous clouds of vapor which floated about it. The testimony of a trained eye and a camera, it is hardly necessary to point out, is much more trustworthy than the stories of ignorant Aleuts, who only half understand the questions addressed to them, and who would not be mortal if they did not mix fact and fiction inextricably." "The Pacific Ocean is almost completely encircled with traces of volcanic activity in the remote past. Shasta, Rainier, and Hood, bear silent witness to that which once occurred in the United States, but which the geologists say can never occur here again. To study volcanic forces in actual play near the edges of that vast sea, one must go up to Alaska, down to Mexico, or still farther southward; or else across to Asia. Time and money might be saved by stopping in Hawaii, for it is comparatively safe to inspect Mauna Loa, even when its discharges are the most copious, and when it is on its good behavior the visitor may gaze down into its very crater." Much greater violence is exhibited by some of the volcanoes of Japan and the East Indies. "A far

greater loss of life resulted from the explosion of Krakatoa, near Java, in 1883, than from the eruption of Pelee in 1902, or of Vesuvius this year, 1906."

In order that we may not form a false impression from the foregoing article and in order to straighten out a few kinks that may have previously been formed in our minds, we wish to say, that observation and experience both teach us not to put any confidence in any impression that may tend to make us think that subterranean forces are in any sense subsiding; or that volcanic activity is in any sense dying out. For the reverse is the case. Because we have had one earthquake is no proof that we will not have another. Because we have had one volcanic eruption is no sign we will never have another; and because we have never had either is no evidence that we will forever escape. No matter what geologists say, observation and experience is to the contrary. From the time A. D. 63 to A. D. 79, a period of 16 years, continual earthquakes occurred in the vicinity of Vesuvius, and destroyed Herculaneum and Pompeii. At the end of the 16th year Vesuvius burst forth with a power and a fury never witnessed before by mortal man; and overwhelmed Herculaneum and Pompeii and Stabia, and completed the ruin begun 16 years before by earthquake. Vesuvius then slept 124 years and came again with all its fury. It then slept 269 years, or two generations, and belched forth again as strong as ever. It then slept 40, 173, and 351 years and came forth again with renewed vigor. Since 1036 when Vesuvius had been dormant for 351 years, it has been belching forth liquid fire at irregular intervals. Now, after knowing this, is it safe to say any volcano is extinct? If a volcano lies dormant 351 years, may it not lie dormant 500 or 1,000 or 5,000 years? Why not? So, we see that the assumption that earthquakes or volcanoes may not occur again is very erroneous. It is a theory founded on hope and despair; and not substantiated by the facts. Really, the immediate cause of earthquakes and volcanoes is very simple—**fire and water.** Now, how the **fire and water** get together and cause the explosion, incandescent heat, and eruption is entirely a different question, and can be explained only on the simple laws of contraction and expansion. Now, we know that the water is everywhere—on the earth, in the earth—but how

about the fire which is hot enough at the short distance of 34 miles from the earth's surface downward, to fuse platinum! There is only one explanation: Gravitation, which is constant and which is ever pressing every particle of matter in the earth toward the center as the square of the distance, produces such a tremendous pressure that heat or fire is being constantly generated in the interior of the earth and must be relieved from time to time or the earth would be blown to atoms and the meteoric slags would be taken up by some other planet through the law of gravitation. Can anything be plainer? We will give more on this subject at the proper time and place.

CHAPTER V.

THE SAN FRANCISCO EARTHQUAKE.

WHAT IT WAS AND WHAT IT TEACHES.
THE GOLDEN GATE CITY.

ONE OF AMERICA'S WORST DISASTERS.

Press Dispatch:—San Francisco, California's largest city, with a population of 375,000, was visited by a disastrous earthquake early Wednesday morning, April 18th, 1906. Fire, which broke out in the ruins shortly after, was still burning fiercely at midnight, the water works system having been damaged and the fire department rendered practically helpless. Conservative estimates place the loss of life between five and seven hundred, while the property damage is in excess of one hundred millions. Twenty thousand people are homeless. The business section of the city fared worst financially, and the loss of life was greatest in the tenement district; both as to loss of life and property damage, it seems to be about on a par with the great Chicago fire of 1871. The Galveston flood and the Johnstown flood make it pale into insignificance when only loss of life is taken into consideration. The shock occurred at 5:10 o'clock in the morning and lasted only 3 minutes; but in that short time thousands of buildings were damaged or destroyed and from five to seven hundred lives were

Fig. 3—San Francisco before the earthquake and fire.

lost, and thousands injured. Terror and excitement were indescribable. Most of the people were asleep and rushed into the streets undressed. The buildings swayed and cracked, burying their occupants. Added to the horror created by the falling buildings, fire broke out and in an amazingly short time had swept a territory of two miles, taking in and consuming vast blocks of business houses, newspaper offices, churches and hotels. According to the last information the buildings of the Call, Examiner and Chronicle, the Merchants' Exchange owned by the Union Pacific railroad, the Palace and Valencia hotels, and other large buildings were destroyed by fire. Everything south of Market Street from Eighth Street to the water front, and north of Market Street from Sansom to Broadway is gone. The Western Union, and Postal Telegraph buildings were completely wrecked. In order to check the spread of the flames a number of buildings are being destroyed by dynamite. Practically all the wholesale district has been destroyed by fire and the flames are spreading into the Hays Valley district, a resident section of San Francisco. The City Hall, a $7,000,000 structure, was one of the first to collapse after the shock. It took but a moment to reduce it, together with numbers of buildings in that vicinity, into a tangled mass of ruins. The fire is still raging. The catastrophe is the worst in the history of this city.

ENTIRE CITY DOOMED TO DESTRUCTION.

San Francisco, April 18 (10 p. m.)—It looks now as if the entire city would be burned. The Associated Press men are trying to get matter to Oakland by boat, but they are very uncertain of success. The Government is furnishing tugs, but the confusion is so great that they cannot be relied upon. It will be impossible to send full details for several days.

MESSAGES OF SYMPATHY WIRED TO THE STRICKEN CITY OF SAN FRANCISCO.

Washington, April 18.—President Roosevelt manifested profound interest throughout the day in the news of the earthquake at San Francisco. Early in the day he sent the follow-

ing telegrams to Governor Pardee at Sacramento and to Mayor Eugene E. Schmitz at San Francisco: "Washington, April 18, 1906. Hear of great disaster through an earthquake at San Francisco, but know nothing of the real facts. Call upon me for any assistance I can render."

"THEODORE ROOSEVELT."

Later in the day he sent the following dispatch to Mayor Schmitz: "I share with all our people the horror felt at the catastrophe that has befallen San Francisco and the most earnest sympathy with your citizens. If there is anything that the Federal Government can do to aid you, it will be done."

"THEODORE ROOSEVELT."

He also sent the following to Governor Pardee:. "It was difficult at first to credit the news of the calamity that had befallen San Francisco. I feel the greatest concern and sympathy for you and the people, not only of San Francisco, but of California, in this terrible disaster. You will let me know if there is anything the National Government can do."

"THEODORE ROOSEVELT."

By Mayor of Boston: Boston, April 18.—As soon as he learned of the disaster in San Francisco, Mayor Fitzgerald, of this city, sent the following telegram to Mayor Schmitz, of that city: "Boston extends sincere sympathy in the calamity that has befallen your city. Can we help you?"

Following the sending of the telegram to Mayor Schmitz, Mayor Fitzgerald called a meeting of business men at which it was voted a relief committee be appointed and $25,000 raised by subscription to aid San Francisco. Governor Guild was present at the meeting.

By Mayor McClellan: New York, April 18.—Mayor McClellan sent the following dispatch addressed to Mayor Schmitz, San Francisco: "The city of New York expresses its horror and profound grief at the calamity that has fallen on San Francisco. If New York, in any way, can aid, in any form, your stricken city, command me."

By Nashville Board of Trade: Nashville, April 18.—The Nashville Board of Trade has sent the following telegram to

Fig. 5—Camping in the open park.

the Mayor of San Francisco: "The people of Nashville, through their Board of Trade, extend sincere sympathy to your saddened and afflicted city."

"LELAND HUME, President."
"E. A. SHANNON, Secretary."

By Grand Exalted Ruler B. P. O. E.: Louisville, April 18.—Grand Exalted Ruler R. W. Brown, of the Order of Elks, sent a telegram to the grand officers in San Francisco today, extending condolence and asking if the grand lodge could be of service to brother Elks or others.

EARTHQUAKE RECORDED ON THE SEISMOGRAPH.

Washington, April 18.—The weather bulletin this afternoon issues the following special regarding the San Francisco earthquake: "The San Francisco earthquake of April 18, 1906, was registered upon the Bosch Omori seismograph at the weather bureau office at Washington, beginning at 8 hours, 19 minutes, 20 seconds, 75th meridian time. The record shows a disturbance of considerable magnitude at Washington, although not severe enough to be felt by individuals. The stronger wave motion began at 8:25 a. m., about 5 minutes after the first imperceptible tremors. The recording pen was carried entirely off the record sheet by the violence of the motion from 8:32 to 8:35 a. m. After the latter time the motion gradually diminished over a longer period of time, but did not entirely cease until about 12:35 p. m. The vibration motion of the ground at Washington was really a comparatively slow and deliberate motion, each back and forth movement taking 15 to 20 seconds of time."

"WILLIS L. MOORE, Chief."

"In connection with the vibrations in this city, Prof. Willis Moore, of the Weather Bureau, said today that the eruption of Vesuvius was recorded during its entire period on the magnetic instruments of the research station at Mount Weather, a few miles from this city in Virginia. Prof. Moore was not prepared to say whether the eruption of Vesuvius has anything to do with the present earthquake. The seismograph at the weather bureau here at 12:45 o'clock p. m. was still recording violent vibrations. The second shock felt in San Francisco at

8:15 o'clock this morning was clearly indicated by the weather bureau instruments, thus showing that the entire contingent still is affected."

Albany, N. Y., April 18.—"The seismograph in the Geological Academy showed marked agitation at 2:16 a. m. this morning and continued the record for several minutes."

ANOTHER AND GRAVER DISASTER PREDICTED FOR SAN FRANCISCO.

Rochester, N. Y., April 18.—"Another and even a graver disaster than the earthquake threatens San Francisco. A tidal (ocean) wave would not be unlooked for as an accompaniment to the present seismic disturbance," said Prof. W. H. Fairchild, of the University, today. "Much of San Francisco is only 12 feet above tide water and this fact renders it particularly liable to destruction in such an event."

NO WARNING OF CATASTROPHE.

"The dreadful earthquake shock came without warning, at precisely 5:15 o'clock this morning, its motion apparently being from East to West. At first the upheaval of the earth was gradual, but in a few seconds it increased in intensity. Chimneys began to fall and buildings to crack, tottering on their foundations. The people became panic-stricken and rushed into the streets, most of them in their night attire. They were met by showers of falling buildings, bricks, cornices and walls. Many were instantly crushed to death, while others were dreadfully mangled. Those who remained indoors generally escaped with their lives, though scores were hit by detached plaster, pictures and articles thrown to the floor by the shock. It is believed that more or less loss was sustained by nearly every family in the city. The tall steel frame structures stood the strain better than brick buildings, few of them being badly damaged by the shock. The new City Hall which cost $7,000,000, collapsed."

GREATEST CALAMITY IN CALIFORNIA'S HISTORY.

Press dispatch:

San Francisco, April 18.—Earthquake and fire have today put nearly half of San Francisco in ruins. About 500 persons

have been killed, a thousand or more injured and property loss will exceed $100,000,000. Thousands are homeless and destitute and all day long streams of people have been fleeing from the stricken districts to places of safety. It was 5:13 o'clock this morning when a terrific earthquake shock caused the whole city and surrounding country to vibrate. The first shock apparently lasted two minutes and there was almost immediate collapse of flimsy structures all over the city. The water supply was cut off and when fire broke out in various sections there was nothing to do but let the buildings burn. Telegraph and telephone communication was shut off for a time. The Western Union was put completely out of business and the Postal Company was the only one to get a wire out of the city. About 10 o'clock even the Postal was forced to suspend. Electric power was stopped and street cars did not run. Railroads and ferryboats ceased operations. Fires have been raging all day and the fire department has been powerless except to dynamite buildings threatened. All day long explosions have shaken the city and added to the terror of the people. Following the first shock, there was another within five minutes, but not so severe. Three hours later there was a slight quake.

Reports from districts outside of San Francisco indicate widespread damage. San Jose, 50 miles South, lost many buildings and about 20 persons were killed. The conflagration spreads. The commercial establishments and banks North of Market Street are burning. The entire city seems to be in flames. Soldiers patrol the city. At 9 o'clock this morning 1,000 men from the Presidio arrived down town to patrol the city streets. The Thirteenth Infantry, 1,000 strong, arrived from Angel Island a little later and went on duty. The soldiers have been ordered to shoot down thieves caught in the act of robbing the dead, and to guard with their lives the millions of dollars worth of property which has been placed in the streets that it may escape the ravages of the flames.

SOUTHERN CALIFORNIA CITIES DID NOT SUFFER.

Los Angeles, April 18.—From inquiries received in this city from points in the East, it appears that the impression has gone out that the earthquake which caused such devastation in San Francisco this morning also affected Los Angeles and

other Southern California points. This is entirely an erroneous impression. The shock was not felt farther South than Santa Barbara.

THE FEDERAL GOVERNMENT EXTENDS AID.

Washington, April 18.—The following resolution authorizing all possible aid to be extended to the sufferers from the San Francisco earthquake was adopted in the House today. "Resolved, by the Senate and House of Representatives of the United States of America in Congress assembled, that the Secretary of War be, and he is hereby authorized and directed to loan to the Mayors of the cities of San Francisco, Berkely, Oakland, Alameda and such other cities on the Pacific coast as have sustained damages, under such regulations and restrictions as he may deem proper, a sufficient number of tents to temporarily shelter such persons as may have been rendered homeless and lost property by the earthquake of this date and attending conflagration, and to issue rations, supplies, and render such other aid to such as are destitute and unable to provide for themselves. Be it further provided, that the Secretary of the Treasury and the Secretary of the Navy are also hereby directed to co-operate with the Secretary of War in extending relief and assistance to the stricken people herein referred to, to the extent of the use of the naval vessels, revenue cutters and supplies under their control on the Pacific."

San Francisco, April 18.—Fire has done the great damage. An area of 8 square miles has been burned out and no telling when the fire will be under control. Mayor Schmitz was about early this morning and took measures for the relief and protection of the city. Gen. Funston was quickly communicated with, and by 9 o'clock 1,000 federal soldiers were guarding the streets and assisting the firemen in dynamiting buildings. Gen. Funston realized that stern measures were necessary and gave orders that looters were to be shot at sight. Four men were summarily executed before 3 o'clock this afternoon.

MAYOR'S PROCLAMATION.

At a meeting of the committee of safety today Mayor Schmitz issued the following proclamation: "To the citizens of San Francisco: The federal troops, which are now

FIG. 6—Cracks caused by the terrible convulsion.

policing a portion of the city, as well as the regular and special members of the police force, have been authorized by me to kill any persons whomsoever engaged in looting the effects of any citizens or otherwise engaged in the commission of crime. Under these circumstances, they request that all citizens whose business does not imperatively require their ab-

FIG. 7—The road broken in two. The offset is 20 feet.

sence from home after dark, to remain at home after night until order shall have been restored. I beg to warn all citizens of the danger of fire on account of defective or destroyed chimneys, gas pipes, gas fixtures, and the like."

"E. E. SCHMITZ, Mayor."

FREAKS OF THE EARTHQUAKE.

Wide fissures were made in the streets, street railways were twisted out of line, sewers and water pipes were burst and it is feared that there will be an epidemic of disease. Provisions are sold at fancy prices and even water is vended by the glass.

SAN FRANCISCO IS DOOMED TO TOTAL DESTRUCTION. CITY WILL BE REDUCED TO AN ASH HEAP.

San Francisco, April 19.—Two-thirds of the American Paris have been reduced to ruins and the Fire Marshal advises that there is no possibility of saving the rest of the city. Gen. Funston wires the War Department that it is almost certain that the entire city will be destroyed, with the exception of the vaults containing all cash on hand. All efforts to check the spread of the flames at Van Ness avenue proved fruitless. The fire has spread across the broad thoroughfares, and from present indications the entire western addition, which contains the homes of San Francisco's wealthier class, is now doomed. Thousands and thousands of people are flocking to the ferries, to the parks, to the military reservations and to the suburbs. The dead in many instances are lying in the streets and in the ruins. The authorities are doing all in their power to remove the bodies in order that a pestilence may be prevented. President Roosevelt issues an appeal for aid for the earthquake sufferers, the distribution to be made through the American Red Cross. Contributions may be sent to Jacob H. Schiff, New York, Red Cross Treasurer, or other local Red Cross Treasurers. The Presidio reservation, the vast district of thousands of acres, Golden Gate Park, and the surrounding hills resemble one vast picnic ground. Tents and improvised coverings have been erected everywhere; fire-places built in the streets, beds and mattresses thrown down all over the section. Every grocery in San Francisco has been taken by the authorities, and each family is being sold only one article at a time.

FIG. 8—Water Tank thrown from its foundation.

Berkeley, Cal., April 19.—The work of providing meals and sleeping accommodations for the large number of refugees that are pouring into Berkeley by every train from San Francisco, was heartily carried on today and tonight by university and townspeople alike. President Wheeler has thrown open the grounds of the University of California to the refugees

FIG. 9—The fence before the earthquake was straight. The offset now is 8½ feet.

from the burning city across the bay and the churches are supplying food. The women of Berkeley are baking all the bread they possibly can.

Oakland, Cal., April 19.—Oakland tonight housed and fed fully 50,000 refugees of the stricken city across the bay. All day the stream of humanity has poured from the ferries, every one carrying personal baggage and articles saved from the conflagration. Thousands of Chinese, men, women and children, all carrying luggage to the limit of their strength, poured into the limited Chinatown of Oakland.

THE EARTHQUAKE IN CALIFORNIA VIEWED IN CONNECTION WITH OUTBREAK OF VESUVIUS, INDICATES APPROACHES OF FURTHER TERRESTRIAL CONVULSIONS.

Rome, Italy, April 19.—The seismograph in the observatories throughout Italy yesterday recorded distant earth shocks. Those of the observatory at Florence, which has the most perfect instruments, indicated that an earthquake had been felt at a distance of over 7,000 miles. The shocks were so severe that they injured the instruments. The director of the Florence observatory is of the opinion that the earthquake in California viewed in connection with the outbreak of Mt. Vesuvius and the earthquake in Calabria in September last, indicates the approach of further terrestrial convulsions. King Victor Emmanuel was most impressed with the news from California, following so soon after the Calabria disaster and the eruption of Mt. Vesuvius. He said that no one can sympathise more than the Italians with sufferers in and about San Francisco, adding that he felt most anxious for the thousands of Italian emigrants in California.

The news was communicated to the Pope by Cardinal Merry del Val, the Secretary of State. The pontiff gave orders that he be kept informed of all the developments, especially in regard to the safety of Archbishop Riordan and of the clergy of San Francisco.

CONGRESS APPROPRIATES $1,000,000.

Washington, April 19.—The house today appropriate $1,000,000 for the suffering and homeless in San Francisco an other California towns. The resolution was hurried to th Senate and late in the afternoon it was returned with the an nouncement that the senate had concurred in the action of th house. Speaker Cannon's signature was attached at once t the measure and it was rushed to the senate for the vice-presi dent's signature and thence to the president to complete th legislation. Vice-President Fairbanks signed the California re lief bill at 5:05 o'clock and it was at once sent to the Whit House. The president at 6 o'clock tonight signed the join resolution appropriating $1,000,000 for the relief of the Sa Francisco earthquake sufferers. All the express companies an railroads expressed a willingness to carry all relief supplie free.

The big subscription list is headed by John D. Rockefelle with a contribution of $100,000. The United Railway Invest ment Company, with $75,000. Guggenheim Sons, $50,000, an the Carnegie Hero Fund and J. P. Morgan & Co., $25,000.

Atlanta, Ga., April 19.—A special meeting of Atlanta Cit Council this afternoon authorized the appropriation of $5,00 for the relief of the sufferers by the district board of trade The amount was immediately transmitted by telegraph t Mayor Schmitz, next to the government appropriation, bein the first to reach the stricken city. Subscription lists have bee opened at the office of the daily papers here.

Philadelphia, April 19.—The quartermaster's departmen in this city shipped today to San Francisco 3,500 tents, all tha were available.

San Francisco, April 19.—San Francisco tonight is the cit desolate. All she had on earth, is in the ashes.

Chicago, April 19.—Fire insurance companies had abou $250,000,000 at risk in the city of San Francisco. San Fran cisco has been the best profit producer on the coast.

Nashville, Tenn., April 19.—The Nashville board of trad has issued a call for contributions to help the San Francisc sufferers.

EARTHQUAKE SHAKES MICHIGAN.

Calumet, Mich., April 19.—An earthquake shock which was felt distinctly throughout Hancock and was more pronounced in the Quincy mine, killed Timothy Teary and injured four others while working one mile below the earth's surface in that property today. In numerous instances buildings rocked, chimneys fell and dishes rattled, terrifying the citizens and causing scores of men, women and children to rush from their homes. Many miners on the day shift refused to go below again.

Little Rock, Ark., April 19.—The Arkansas Bankers' Association, at its sixteenth annual meeting which convened here today, unanimously appropriated $10,000 for the relief of the earthquake sufferers at San Francisco.

Mobile, Ala., April 19.—Many prominent citizens of Mobile attended a meeting at the chamber of commerce today at noon and started a subscription for the San Francisco earthquake sufferers. Upwards of $500 was raised in a few seconds and arrangements made for subscriptions.

Chattanooga, Tenn., April 19.—Mayor Frierson has sent the following telegram of condolence to Mayor Schmitz of San Francisco: "I tender the profound sympathy of the people of Chattanooga. Our citizens desire a part in relieving the distress. Will immediate contribution by wire be acceptable?"

Atlanta, Ga., April 19.—Governor Terrell today issued a proclamation to the people of Georgia calling upon the cities and towns of the state to contribute money and supplies for the relief of the San Francisco sufferers. He also sent the following telegram to Governor Pardee, of California: "The people of Georgia sympathize deeply with your people and esteem it a privilege to contribute liberally toward relieving their sufferings. Have issued a proclamation calling upon Georgians to make contributions and will thank you to inform me as to whom money should be sent."

Montgomery, Ala., April 19.—The Commercial Club of Alabama telegraphed today authorizing Mayor Schmitz of San Francisco to draw upon the club for $1,000 to be used for relief work in the stricken city.

Knoxville, Tenn., April 19.—Mayor Heiskell sends message: "To the Mayor of San Francisco, Cal.: The people of the whole civilized world will profoundly sympathize with the citizens of San Francisco and the State of California in their unspeakable misfortunes. It recalls the horrors and awful desolation of Herculaneum and Pompeii and demands from your people a faith as boundless as that of the ancient patriarch in the God of Job. But Californians have been great in all the enterprises of man and the world will look for a resurrection from your calamities as glorious as your past achievements have been in pushing forward the progress of civilization.

S. G. HEISKELL, Mayor."

The board of trade has wired sympathy to the board of trade of San Francisco, and asked if any assistance can be rendered.

MAYOR DUNNE'S CONDOLENCE.

Chicago, April 19.—Mayor Dunne returned from his eastern trip today and immediately upon reaching his office, sent the following message to Mayor Schmitz, of San Francisco: "Accept Chicago's most profound sympathy in great affliction. In what way can we best serve your relief?"

U. S. MINT AT 'FRISCO ESCAPES SERIOUS DAMAGE.

Washington, April 19.—The United States mint at San Francisco escaped serious damage from the earthquake and the resulting conflagration and its stock of gold and silver coin and bullion amounting to $39,000,000 is safe.

EVENTS SHOULD MAKE MEN THINK.

IS THE COMING OF CHRIST ABOUT TO BE FULFILLED?

Suggesting that passage of the scripture which refers to the second coming of Christ on earth to be preceded by "wars and rumors of wars," pestilence, plagues, floods, fires and earthquakes and famines, a gentleman at one of the hotels in Knoxville, Tennessee, last evening took for his text the calamity that has befallen San Francisco and that section of country in Wednesday's terrible earthquake. "We have certainly had

wars and rumors of wars," he said. "Plagues have destroyed crops and produced famines in large sections of the world. A famine exists in Japan today over a wide area. Cholera has raged, the bubonic plague has killed thousands. In our own country yellow fever and smallpox have carried off thousands. A tidal wave swept away Galveston, and thousands have been killed from volcanic eruptions in the islands of the sea. Mt. Vesuvius has recently erupted and hundreds are dead and millions of dollars worth of property have been destroyed. Now the great western city of San Francisco has been laid low by an earthquake and fire. Surely events in the past few years, even in the past few weeks, should make men think."

SOUTH URGED TO IMMEDIATE ACTION.

Baltimore, Md., April 19.—The Manufacturers' Record of today, in a double-headed editorial urges that the entire South take immediate action in the contributions to aid San Francisco, and says. "Out of its abundance and its sympathy born of recent memories of Meridian, Baltimore, Jacksonville and Galveston, the South has a chance to render signal service in organizing prompt relief for the suffering that has been entailed upon the people of the metropolis of the Pacific coast as a result of the San Francisco earthquake. Who acts immediately, acts with effect."

BRAWLEY, CAL., WIPED OUT BY EARTHQUAKE.

Los Angeles, Cal., April 19.—Reports from Brawley, a small town on the Southern Pacific, 120 miles South of Los Angeles, state that the town was practically wiped out by the earthquake of yesterday. This is the only town in Southern California known to have suffered from the shock. Southern Pacific officials here today say the following buildings, all brick structures, were destroyed: Brawley Bank building, Pauline building, and the principal merchandise buildings of the town. In addition dozens of adobe houses were razed. So far as known, there were no fatalities. Brawley is about two years old and had a population of about 500.

EARTHQUAKE AT LOS ANGELES.

NO DAMAGE WAS DONE, BUT THOUSANDS WERE FRIGHTENED.

Los Angeles, April 19.—At 12:33 o'clock this afternoon, Los Angeles experienced a distinct earthquake shock of short duration. No damage was done, but thousands of people were frightened. Occupants of office buildings, especially of tall structures, ran out into the streets hatless. Many stores were deserted in like manner by customers and clerks. The shock passed soon and most of those who had fled returned to the buildings. The San Francisco horror has strung the populace here to a high tension and a spell of sultry weather serves to increase the general nervousness.

KING EMMANUEL'S CONDOLENCE.

Rome, Italy, April 19.—The King has cabled to President Roosevelt his sympathy in the San Francisco disaster and Premier Sonnino and Finance Minister Luzzati have personally condoled with Ambassador White, who today abstained from attending the races, a great social event.

The following are the donations and donors of this date, April 20: President Roosevelt, $1,000; E. H. Harriman, of Omaha, Nebraska, $200,000; The Mystic Shriners of Chicago, $100,000; Carnegie, $100,000; Standard Oil Co., $100,000; Steel Corporation, E. H. Gary, chairman, $100,000; Sub-Treasury transfers $1,400,000; U. S. Government contributes another $1,000,000; Drexel & Co., of Philadelphia, $75,000; Seattle, Washington, $40,000; Massachusetts Relief Fund of Boston, $100,000; Steamship Co. of Hamburg, $25,000; Columbus, Ohio, $20,000; Chicago sends supplies; one packing house started 8 cars of meat today; Minneapolis is sending flour; Charleston, S. C., $5,000; Jacksonville, Fla., $10,000; U. S. Government order 500,000 rations purchased at Los Angeles for the San Francisco sufferers; and also dispatch today ten large freight car-loads of tents, mattresses, blankets and cots from St. Louis, Mo.; Wm. Vanderbilt, of New York, $25,000; Kuhn, Loeb & Co., bankers of New York, $25,000; a man who was unknown to Mayor McClellan and who would not give his name, $25,000.

He only said it was clean money and given by a friend to humanity; Knoxville, Tenn., $5,000.

New York, April 21.—The voiceless appeal of San Francisco has been heard throughout the civilized world. From every city and town in this country, from European capitals and from far eastern communities comes news that all humanity is not only expressing its sympathy, but is also offering material assistance. From the incomplete figures of the contributions already made, it is estimated that up to this date, April 21, 1906, that the contributions for the earthquake sufferers is nearing the $10,000,000 mark. New York City will send upward of $2,000,000; Massachusetts, including Boston, $3,000,000; Chicago upwards of $1,000,000; Philadelphia, $500,000; and a score of other cities are contributing $100,000 and more. These are but a few of the larger sums. From London, Paris, Berlin, and wherever Americans are congregated, a generous inflow is reported. Wholly foreign contributions are not to be accepted, while deeply appreciated, according to the precedent established by the President yesterday in declining a gift of $25,000 from the German Steamship line.

EARTHQUAKE CAUSES PANIC AT HONOLULU.

Chicago, April 20.—A cable to the Chronicle from Honolulu, the capital of the Hawaiian Islands, says: "For six minutes yesterday a repetition of the San Francisco disaster which would involve the capital of the Hawaiian Islands in destruction was feared. Vibrations which were evidently the result of seismic disorders were felt plainly throughout the city. While earthquakes are by no means infrequent in the Hawaiian Islands, that of yesterday was much more severe than any that has occurred in recent years. It caused many buildings to sway to and fro, and in the residence districts some of the less strongly constructed buildings were demolished. The disturbances caused by the vibrations made the water to rise rapidly in the harbor and fear was felt that a tidal wave might sweep over the city. However, inside of six minutes the vibrations ceased and none further noted during the day. The inhabitants who had learned of the catastrophe which destroyed San Francisco, rushed into the streets and a panic ensued. Fear of possible disorders as a result of the panic, caused the landing

of a considerable force of marines from the men-of-war in the harbor. Order was restored within an hour, however, and the population went on its way as if nothing out of the ordinary had happened."

THIRTEEN EARTH SHOCKS AT TUSCANY.

Rome, April 21.—Thirteen earth shocks were felt in succession this morning in the province of Siena, Tuscany. Several buildings were damaged, including the City Hall at Boggibonsi, nineteen miles South of Florence. The inhabitants of Boggibonsi were panic-stricken. It is not yet known whether Siena was damaged.

SHOCK AT MOSCOW.

Moscow, April 21.—Practically simultaneous with the San Francisco earthquake a slight shock was felt here. The seismograph in the Moscow University registered the disturbance almost to the hour, reckoning the difference in time.

EARTHQUAKE AT SOCORRO, NEW MEXICO.

In July, following the great earthquake in San Francisco, a terrible earthquake nearly destroyed Socorro, New Mexico. The people were panic-stricken and reported that the disaster was as great as at San Francisco, in comparison to the two cities.

On August 16th, following San Francisco, fully as horrible and devastating an earthquake shook down and burned Valparaiso, in Chili, South America. Now, the object in giving such a full account of the earthquake at San Francisco, and giving several others which followed right along in regular order, beginning at our New Island in the Polar Sea and traveling southward, taking Valparaiso in its path, is that I wish to prove that the report of the investigating committee appointed by the Governor of California, on the cause of the San Francisco quake, is erroneous and false. With all due regard for the positions that some of the committee hold, and with all due respect for their knowledge and experience in geology, they ought to know from what preceded and what followed, that the San Francisco disaster could not be brushed away by

simple motion of the hand. They ought to know without any previous knowledge in geology, that the same cause that raised our new island in the Polar Sea, up near Alaska, and the same cause that shook Moscow simultaneously with San Francisco, and the same cause that devastated Socorro, in New Mexico, and Valparaiso in South America, is the same cause that produced the earthquake that ruined the Paris of America, San Francisco. But before we go farther into the discussion of this subject, let us give the committee's report in order that all may see just what they did say. Following is the report of that committee:

REPORT OF THE SAN FRANCISCO EARTHQUAKE INVESTIGATION COMMITTEE:

STRESSES ARE GENERATED IN THE EARTH'S CRUST AND FIND RELIEF IN SUDDEN RUPTURE—SAY THE INVESTIGATORS.

Sacramento, Cal., June 4.—The preliminary report of the State earthquake investigation has been received at the office of Governor Pardee. Under the heading of the results the report says: "One of the remarkable features of the coast ranges of California is a line of peculiar geometric construction, which extends obliquely across the entire width of the mountainous belt from Mendocina County to Riverside County. The surface feature along this side has been formed by a dislocation of the earth's crust, or a series of dislocations in times past, with a differential movement of the parts on either side of the plane of rupture. The movements that produced the line are attributed to separate earthquakes, extending back into the quarternary period. In general terms the causes are generated in the earth's crust and find relief in sudden rupture. The earthquake of April 18th, is said to have been due to one of these movements and the extent of the 'rift' is described as extending from the vicinity of Point Arena to the neighborhood of San Juan, Benito County, a distance of 185 miles. The evidence of the rupture and of the differential movements is clearly defined in a continuous furrow in the surface soil several feet wide. The average horizontal displacement is twenty feet wide. In Sonoma and Mendocino counties there is a different vertical movement not exceeding four feet." "In consequence

of this movement," the report goes on to say, "it is probable that the latitudes and longitudes of all points in the coast range have been permanently changed a few feet. A complete study of the phenomena will undoubtedly contribute greatly, not only to our knowledge of the means of minimizing the calamities which arise from the destruction of buildings and water pipes when such shocks occur in the future. Modern classes of structures appear to have been relatively passive, while the 'made' ground in the vicinity was profoundly disturbed. The weak points in the frame buildings were the faulty underpinning, lack of bracing, and the chimneys. Pipe lines on low, swampy ground, or 'made' ground, are in greater danger of destruction than those on high ground underlaid. In San Francisco, the most violent destruction of buildings was on 'made' ground, which behaved as jelly in a bowl. The minor shocks continued for many days after April 18, and in this respect the earthquake accords in behavior with other earthquakes in the past. The minor shocks which succeeded the main one are interpreted generally as due to subordinate adjustments of the earth's crust in the tendency to reach equilibrium after the chief movements."

Now, in beginning where we left off, in showing the inconsistency of the conclusions arrived at in the above report, it seems to us, rather hurriedly, we wish to ask how many, outside of the few geologists interested, do you suppose will believe this report? We will venture to say not over one in a hundred, and why? Because the people of the world are better informed, better read, and more intelligent than to believe such a theory. They look for something better and higher—something that better coincides with all the recent discoveries in physical science—something that accords more closely with the most recent developments in earthquake and volcanic activity. We will be able to prove, before we are done with this discussion, that one prominent member of this committee had but little confidence in this report himself. Whatever the true cause may be, it is very evident that the earthquake that destroyed San Francisco did not occur by the "**earth dropping in**"—for that is what the report means if it means anything at all. Now, if the earth did "slip" or "slide," how far? And where did it go to? How far would the earth have to fall, and

on what kind of a foundation would it have to fall in order to shake down every building in San Francisco, and shake the balance of the earth, from San Francisco to Washington, D. C., —to Florence, Italy, to Porto Rico, to Hawaii, to Alaska, and not only these, but to Moscow, at the same instant, on the other side of the globe? Now, we can conceive of no reason why such a report should emanate from such distinguished scholars and geologists as were on that committee, unless it be to inspire confidence in the people of San Francisco, that the earth may never "fall in" again. In fact it may be a long time at least. We cannot see how the cause of the people or the cause of science can be advanced permanently by issuing reports to inspire confidence temporarily. Would it not be much better to allege this occurrence to its true cause, whether it be understood or not, and place it alongside of the seismic disturbances that have been going on in the well-marked western coast of America, from Behring Sea to Cape Horn, ever since last April? On last June, as we have shown before, a new island was pushed up in the Polar Sea, about 50 miles West of Dutch Harbor. Now, that there is a close connection between earthquakes and volcanoes, there cannot be the least doubt. In fact, they are produced by one and the same cause. The probability is that this island began to form a year or more ago. At any rate it is there; and the same subterranean forces that pushed up this island from the bottom of the sea caused the earthquake at San Francisco, in April, and at Socorro, New Mexico, in July, and Valparaiso, in Chili, in August, and successively onward, in Ecaudor, in Hawaii, and in Porto Rico, shaking San Juan terribly on September 27th, 1906. The subterranean forces began in the North and traveled southward following a well defined and well marked fissure in the earth's crust. This fissure in the earth's crust passes close by San Francisco, and of course this city is liable to be profoundly disturbed when the heat becomes so intense that steam, gases and electricity are generated in such quantities that the cracks, fissures, "faults" and all weak or thin places in the earth's crust cannot withstand the pressure any longer. You must remember there is a limit to all endurance; and the earth is no exception. The report goes on to say that, "In general terms the causes of these movements are attributed to the theory that **stresses** are generated in the earth's

crust and find relief in sudden rupture." Yes, "stresses" are formed in the interior of the earth's crust and find relief in sudden rupture, but not in the way as indicated in the report. The pressure that forms the "stresses" is from within the earth and not by any rubbing together of the rocks as shown in the report. As I have shown before, gravitation pressing every particle of matter in the earth toward the center as the square of the distance, produces such a tremendous pressure that heat is generated in such vast quantities that when steam, gases, and so forth, are generated in such quantities the crust of the

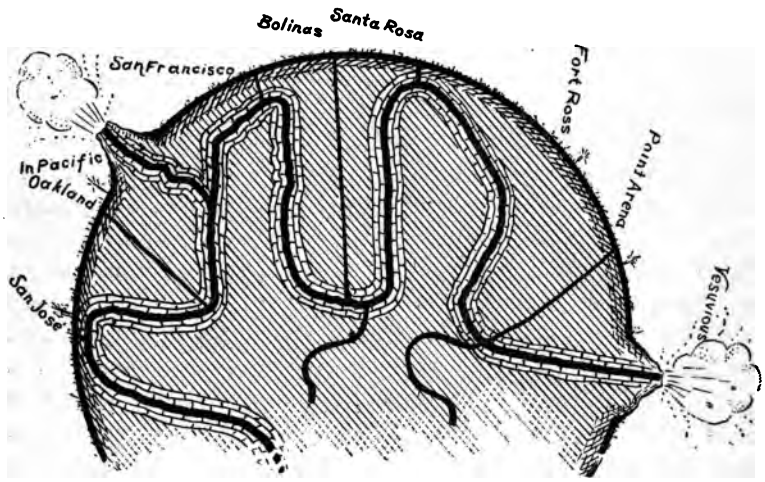

FIG. 10—Chart showing why certain cities in the San Francisco earthquake were disturbed more than others. The lava stream pressing its way through stratified rock was probably 25,000 feet nearer San Francisco than Oakland. And so with other cities.

earth cannot endure it any longer, it "finds relief in sudden rupture."

Mr. Gilbert, of the United States Geological Survey, in his article on the Investigation of the San Francisco Earthquake, who was also a member of this committee, in summing up his report says: "Other disturbances of water supply were more directly connected with the earthquake. At several points large volumes of water were 'squeezed' from the ground during the agitation, causing brief but violent torrents, and one of these brought with it so much sand as to constitute a sort of sand eruption. There are reports also that certain springs have

received a permanent increase in volume, due to underground circulation." He says further: "But after making due allowance for differences in natural foundation and for difference in the resisting power of buildings, there remain various anomalies for which satisfactory explanation has not as yet been found." "The natural foundation of Oakland is similar to that of San Jose, and its distance from the earthquake origin is about the same, but the injury to its buildings was decidedly less; and Santa Rosa, standing on ground apparently firmer than that of Oakland or San Jose, and having a somewhat greater distance from the 'fault', was nevertheless shaken with extreme violence." By taking Mr. Gilbert's statement as true, we need no other proof that the report as formulated by this investigation commission is erroneous and does not coincide with the activities as developed at San Francisco. "At several points large volumes of water were 'squeezed' from the earth"—why not say, truly, ejected from the earth as is the case in such volcanic activities? The word "squeeze" accommodates the report to the theory that the rocks slipped and fell in. "Large torrents came forth, and one of them brought with it so much sand, as to constitute a sort of sand eruption." If we did not know that an earthquake had occurred at San Francisco, we would think that Mr. Gilbert was describing the first appearance of a volcano. For that is the manner in which they make their first appearance—first torrents of cold water, then hot water—sand, mud lava and steam and fire. So it seems that San Francisco was on the verge of a volcanic eruption. A similar instance occurred in the year A. D. 63, when Herculaneum and Pompeii were partially destroyed by earthquakes before Vesuvius belched forth. For three long years these two cities were under the strain of earthquakes, and no one suspicioned that Vesuvius was a sleeping volcano until A. D. 79, when it belched forth with all its fury, erupting, lava, steam, scoria, ashes, sand and pumice-stone, and overwhelmed Herculaneum and Pompeii in its course. That this volcano had been in eruption thousands of years before A. D. 79, no one now doubts. But the oldest man living at that time had no tradition nor history pointing back to such an event. When this occurred, its sides were covered with trees and vines and was inhabited on all sides by living beings, unsuspecting such an event—when,

behold, an earthquake began to do its awful work and kept the panic-stricken people in dread suspense until the mountain burst forth with fire and smoke and completed its terrible devastation. So, while I would not add one grain of fear to the brave and disconsolate people of San Francisco, I would not be surprised to hear of other earthquakes on and on until some great volcano burst forth in mountain or dale, or perhaps from the bottom of the ocean as it did near Charleston, South Carolina, and engulf the whole city in a lava stream or ocean wave. How strange it is that the same God who created the heavens and the earth and fitted it for the special habitation of man, at the same time created a law by which with the touch of one finger He can set the whole universe ablaze and cause rivers of fire to run down our mountain sides and sweep our beautiful cities from the face of the earth. Nevertheless this is so. But why make San Francisco an exception to the general rule? Do we not have numerous instances of earthquakes similar to that at San Francisco on April 18? Aside from a few artificial earthquakes caused by explosion of dynamite or gas in mines, or powder magazines, &c., all earthquakes are caused by the same force. Even if we admit that the "slipping" or "sliding" of the rocks in the earth might possibly make a slight jar, it is only local and would cover only a very limited area, and could not be classed as an earthquake proper. But in all cases where the earth is terribly rent and upheaved it must be admitted that it was caused by a seismic disturbance from within the interior of the earth. We are well aware that some theorists try to argue in support of this "falling in process," that great cavities might be washed away from between strata of underlying rocks, and it might in consequence sink down. The question naturally arises, what would wash dirt from between rocks, and where would such great quantities of dirt and other material go to? To what other part of the earth would it land? Do not all admit that there is a tremendous pressure toward the center of the earth all the time—never ceasing? Could this material go in any other direction than towards the center, with untold millions of tons pressing it downward all the time? The only sensible theory in regard to certain parts of the earth's crust falling in would be that it proceeds towards the center of the earth to feed the molten mass within, in order that it

might again be ejected by Vesuvius and other great volcanoes. But this would be a wonderful stretch of the imagination to think that the earth underlying San Francisco was feeding the vent of Vesuvius. Of course, the internal fires of the earth, constantly throwing up to the surface untold millions of tons of the earth-material, through volcanoes, hot springs, mud-volcanoes, gases, steam, and springs of all kinds, must be fed by the earth's crust, but why should one part of the earth subside any faster than another, when all must be in a molten condition as you approach the center? The **law of gravitation** pressing every particle of matter in the earth toward the center with such a tremendous pressure as to cause the heat to rise on an average of 1 degree Fah. for every 54 feet as you descend, would not permit one part of the earth to descend any faster than another. So, we must look for the explanation of earthquake phenomena to other sources. Nothing but the theory that **gravitation** is the true cause will fully answer all the phenomena. Suppose, for instance, that the earth today was a globe of rock and earth and water without any heat whatever. Can you imagine any other condition than that heat would be generated in the interior in 24 hours? How could it be otherwise unless the law of gravitation be suspended? This is the whole subject in a nutshell. Heat is constantly accumulating in the interior of the earth and can only find relief in "sudden ruptures," through earthquakes and volcanoes.

GOD

"Moves in a mysterious way
His wonders to perform;
He plants His footsteps in the sea,
And rides upon the storm."

CHAPTER VI.

THE VALPARAISO EARTHQUAKE.

WHAT IT WAS AND WHAT IT TEACHES.

Press Dispatch:

VALPARAISO IS BADLY DAMAGED BY EARTHQUAKE. ONE REPORT SAYS SITUATION MAY PROVE TO BE AS SERIOUS AS THAT OF SAN FRANCISCO. PRACTICALLY EVERY BUILDING IN THE CHILEAN CITY IS DAMAGED AND FIRES ARE RAGING. MANY PERSONS ARE REPORTED KILLED AND INJURED. EARTHQUAKE INTERRUPTS CABLE FACILITIES.

New York, Aug. 17.—The city of Valparaiso, Chili, is reported badly damaged by earthquake. One report here is that the situation in Valparaiso may prove to be as serious as that in San Francisco. Practically every building in the city is damaged, and there are fires in different parts of the city. The earthquake has interrupted cable facilities to lower South American points and communication is restricted to the route via Lisbon. One report which reached this city said that portions of Valparaiso were burning all night and that the bodies of hundreds of its residents were buried in the ruins of the buildings.

Valparaiso is a fortified seaport of Chili and the most important commercial town on the western coast of South America. It has a population of about 150,000. It is the capital of the province of the same name; and is situated on a large bay in the Pacific Ocean, 75 miles west northwest of Santiago, with which it is connected by rail. The bay of Valparaiso, which is well sheltered on three sides, is bounded by ranges of hills rising from 1,600 to 1,700 feet high, on the slopes of which a considerable portion of the city of Valparaiso is built. The new sections of Valparaiso have an attractive, modern appearance. The buildings in the business quarter are massively built. Among the monuments in Valparaiso are those to Columbus Wheelwright, who established steam navigation on

Fig. 11—City of Valparaiso, Chili, before the earthquake of August 16, 1906.

the Chilean coast, Admiral Pratt and Thomas Cochrane, organizer of the Chilean navy. The city has various academies and collegiate institutions, a naval school, school of marines, museum of natural history, hydrographic bureau, and its industrial establishments comprise foundries, distilleries, large bottling works and factories of all kinds. Elevators connect the lower parts of the city with the villa section, on the heights. The port of Valparaiso is the terminus of important lines of steamers for Europe by way of the straits of Magellan and Panama, and is the center of the South American coasting service. It contains a numerous foreign colony, composed chiefly of British, German and French merchants. There is a custom-house wharf, alongside of which steamers of ordinary tonnage can moor, but the most of the loading is done by lighters from a quay surrounding the town. Severe storms and a tidal wave at Valparaiso, June 30, 1899, wrecked the railroad and did great damage to the city.

DESTRUCTION OF LOS ANDES IS FEARED.

Buenos Ayres, Aug. 17.—The newspapers this evening published telegrams from Mendoza, which is an entre-port for trade between Buenos Ayres and Chili, to the effect that many houses in the Los Andes district were destroyed by the earthquake and that there has been a large number of casualties. The interruption of all means of communication with Chili causes much anxiety. Many rumors of disaster are afloat. 6 p. m.—In the absence of the telegraphic communication beyond Puento del Inca, it has been impossible up to this hour to obtain accurate details of the destruction by earthquake in Chili. The managers of the telegraph companies here state that nothing is coming through. Press reports purporting to come from Chili are purely imaginary. London and New York are eagerly seeking news from the affected district. Officials of the Pacific railway say that it is their belief that the damage at Valparaiso is not so serious as has been stated, but they express the fear that Los Andes has been destroyed.

London, Aug. 17.—Some London firms trading with Valparaiso have received telegrams from agents there. One, to James and Alexander Brown, says: "Severe earthquake—commerce paralyzed. Town afire. Staff safe."

EARTH TREMORS RECORDED AT WASHINGTON.

Washington, Aug. 17.—A very heavy distinct shock was recorded on the seismograph at the weather bureau in Washington yesterday afternoon, beginning at five minutes and twenty-two seconds past 7 p. m., 75th meridian time. The earth tremors at Washington were of comparatively slow and deliberate motion, each complete movement covering from 18 to 40 seconds time. The earthquake lasted continuously for several hours, and finally ceased about midnight. The most violent shock occurred at 7 hours 42 minutes, 22 seconds p. m.

5,000 LIVES HAVE BEEN LOST IN THE DESTRUCTION OF VALPARAISO.

New York, August 18.—Fully 5,000 persons, according to the latest dispatches from Santiago, Chili, lost their lives in the Valparaiso disaster. Santiago also suffered severely. Thirty people were killed there and the property loss is placed at $2,000,000. Excepting the foregoing, no estimates of damages and casualties caused by the earthquake in Chili, had been received at New York up to 11 o'clock tonight, and the above dispatch lacks confirmation. Panic reigns in both cities. The people are in the grip of fear of further shocks and are fleeing. Refugees from Valparaiso are getting into Santiago, 42 miles away. The disturbances have covered a large area. The shocks were felt in Tacna, in the extreme north of Chili.

A number of minor towns have been either destroyed or materially damaged. Valparaiso has been described as "nearly destroyed," while another message says half the city has become a prey to the earthquake and flames. The loss of life and property is, undoubtedly, very heavy. Telegraphic communication has been established with Chili, but no messages yet have been received from Valparaiso. The first shock occurred Thursday evening about 8 o'clock, and was followed by others at intervals throughout the night. Panic prevailed and the steamers were filled with hysterical, wailing and praying people. Half the inhabitants of Santiago, stayed on the streets or fled to the country Thursday night. Fires followed in Santiago, but were quickly extinguished by a heavy providential downpour of rain. Valparaiso suffered much from fire.

Many people have left the two cities and the stream of refugees continues. The disturbances are confined to the Pacific slope of the Andes, but Iquique, the center of the nitrate industry escaped injury. The disturbances were recorded by seismographs in Washington, Honolulu, Hamburg and Goetlinger. Among the places reported to have been damaged or destroyed are Vina Delmar, 12,000 people, three miles from Valparaiso; Ilqueque and Limache, of 4,000 people each, both in Valparaiso province; Quilota, twenty-eight miles from Valparaiso; Illapel, 5,000 people, 130 miles northwest of Santiago, and other small towns.

Buenos Ayres, August 18.—A telegram from Punta Dryaras says: Seismic disturbances on the Chilean side of the Andes continue. Further severe shocks were felt yesterday evening; the first at 8:40 and the second at 8:50 p. m. A dispatch received here from La Paz says that reports received there show that earthquake shocks continue at Valparaiso, where panic prevails. Loud subterranean rumblings were heard at La Sevena.

Santiago, Chili, August 18.—The worst earthquake ever remembered occurred this evening, beginning about 8 o'clock. Houses fell in the streets which were filled with hysterical people. The clerks at the cable offices say that telegraph lines to the coast are severed. The electric lights are out. As the correspondent is trying to file this dispatch the earthquake is again starting. He can hear people wailing and praying while the fire bells throughout the city are ringing out alarms.

New York, August 18.—The Herald today prints the following: Valparaiso, Chili, via Galveston, Texas.—Without the slightest tremor of warning an earthquake visited this city at 8 o'clock last night, bringing instant death to hundreds of persons and leaving many hundreds more imprisoned in the ruins, many of whom were burned to death before aid could reach them. Fires started immediately after the first shock, and every branch of the city's service was paralyzed. Panic and consternation indescribable followed those who escaped death, and injury. The business section of the city is almost entirely destroyed and fires are still raging. We are suffering here a repetition of the horrors of San Francisco. As night comes on the city presents everything aglow with unobstructed fires and

clouds of smoke and vapor settling into the streets and houses where throngs of homeless ones are wandering about crazed by the awful calamity. Telegraphic communication is cut off in every direction and every one here is too much depressed by the calamity at home to seek information of other places. No trains have arrived in the city or left it since the first shock came, as all of the railroad tunnels are filled and miles of track on the surface are twisted and rendered useless. It is only known from general accounts that death and destruction are on all sides. There were two distinct and terrific shocks, the second one following almost instantly after the first and completing the work of destruction. The day had been unusually calm and pleasant. At 8 o'clock the whole city seemed suddenly to swing backward and forward and then came a sudden jolt of such mighty force that rows of buildings toppled to the earth as if made of brittle plaster. Whole rows of buildings went down and in a few seconds after the second shock had subsided it became known that the business part of the town was doomed. From the Bella Vista section little was heard, but before midnight fires were seen burning there and it was learned that this section of the city also was doomed. The city stands upon a formation of granite gneiss, which seemed to accentuate the force of the shock. Before the stunned people were able to realize the magnitude of the calamity, again the city was shaken with a violence greater than before. The earth in places lifted and pitched the buildings forward. In other places there was a terrible tremor that shook every structure to the ground. This shock continued longer than the first. When it had subsided fires were blazing up, and thousands of terrified persons were praying for the panic swept city. Many landslides have occurred around the city and scores of lives have been lost. At present it is impossible to state the number of dead in the entire city, but it is believed there are several hundreds, many of whom are still in the ruins. It has laid waste the best part of the business portion of the city and has doubtless put Chili back many years in the scale of civilization. The captain of the German vessel Yran, which arrived today at Coquimbo, stated that when 20 miles at sea, he could see the flames raging in Valparaiso. Many inhabitants are terrified with fear of other shocks and the work of rescuing the

bodies is proceeding very slowly. The Bella Vista district ferred to, which is on the hills behind the city, is the most sel residence district of Valparaiso, and apparently suffered t same fate that overtook Nob Hill in San Francisco. .

Santiago, Chili, August 18.—(7:45 a. m.)—All communi tion with Valparaiso has been cut out by the last forty-eig hours; but a mounted messenger reports by way of Quiblc that 500 persons are killed. A large portion of the town burning and there is a scarcity of water. The railway has be cut by landslides. Slight shocks of earthquake continue to felt here. The functions arranged for the entertainment Secretary of State Root, will be abandoned on account of t universal mourning in Chili.

Berkeley, Cal., August 18.—A long distance earthqua was recorded at the students' observatory of the University California at Berkeley during the afternoon of August 16, a cording to Director Lenchner. The record was received on seismograph of the imperial earthquake commission of Japa

ONE HUNDRED THOUSAND PERSONS ARE HOMELES

London, August 20.—In a dispatch from Valparaiso, tl correspondent of the Daily Mail, says: Sixty per cent of th city has been completely destroyed. The death roll is ve heavy. There were 82 shocks during Thursday night, ar there have been 300 more since then. The tremors still co tinue. One hundred thousand people are homeless and des tute. Water is giving out. Surrounding towns have been d stroyed and railroads have been cut.

Valparaiso, August 19.—At 7:52 o'clock last Thursda evening Valparaiso experienced an earthquake of great seve ity, and during that night 82 shocks were felt. Most of tl buildings of the city were ruined or damaged. The loss will b enormous, probably $250,000,000.

Two thousand persons killed is a fair estimate. Most c the damage was due to fire which started immediately after th first shock. The whole population are fleeing to the hills, th parks or the streets. Food is very scarce and high. Famin confronts the people.

Santiago, Chili, August 19.—It is known that at least eigh lives were lost in this city by the earthquake; but it is believe

that many persons were killed by the falling buildings and that their bodies will be discovered later. Several persons became so panic stricken during the trembling of the earthquake that they threw themselves from the balconies of their homes and were killed. Proportionally the catastrophe here is considered greater than that which befell San Francisco. Valparaiso and neighboring towns are wrecked and practically burned. The ruin is complete.

Valparaiso seems to be a specially unfortunate town. It has been twice sacked, three times destroyed by an earthquake and three times scourged by fire. No city in South America has been visited by so many calamities. In 1730, the first great earthquake shook Valparaiso to the ground. Practically the whole town was destroyed and only after many years of slow progress did it recover. In 1822 a second earthquake came to shake down what had been rebuilt. A great fire swept the city in 1843, destroying a million's worth of property; and in 1858 another fire swept the city destroying five times as much as at first. And now comes another great earthquake destroying $250,000,000 worth of property and taking at least 5,000 lives.

THE SITUATION AT VALPARAISO.

(From the Literary Digest, Sept. 1, 1906.)

"Vesuvius, San Francisco, and now Valparaiso, are the three immediate causes for the remark of the Philadelphia Ledger that 'the habit of referring to the globe as **terra firma** is unduly flattering.' The rapid succession of these three enormous disturbances calls forth widespread comment upon the instability of the earth's crust in general and the necessity for precautionary measures in those localities liable to be afflicted. The Brooklyn Eagle has this to say: 'While the severest earthquakes affect the coast of the Pacific—this despite the disasters of Lisbon, Caracas, and Charleston—it behooves every important city, especially near the coast, to assure its water supply against emergencies, to bury its telegraph and other wires, for it is the fall and breaking of poles that has interrupted all forms of electric service in late instances as well as carried danger, and to study the effect of seismic shock on various types of buildings with a view to eliminating the least

resistant forms.' The great similarity of the disasters in San Francisco and Valparaiso is the cause of much speculation as to the geological reasons for their occurrence. The Philadelphia Record, however, observes that in the presence of so much suffering, 'scientific speculation may well be deferred until the demands of humanity shall have been satisfied.' The Detroit News finds room both for expressions of sympathy and for a little 'scientific speculation' with this result: 'The cause of the Valparaiso quake was apparently the same as that of the San Francisco disaster—a readjustment of the geological fault in the underlying strata. The break between the foot hills of the Andean range and the ocean depths had reached a stage where further settlement was possible and it took place with very short notice to the insignificant creatures living on the surface. The Valparaiso affair is only another chapter in the story of the earth, and later chapters are likely to be added until the backbone which buttresses two continents has undergone adaptation to its burden of all points between the Arctic Ocean and Cape Horn.' Loss of life 1,000. Damages to property $250,000,000. The Detroit News is correct in saying 'that the cause that produced the Valparaiso quake is the same cause which produced the San Francisco disaster;' but is incorrect in saying 'it was due to a readjustment of the geological fault in the underlying strata.'

"In the case of the Valparaiso quake as in the San Francisco quake, we are liable to form a wrong conception, by not distinguishing accurately between cause and effect. In both of these cases this blunder has been made: The effect is taken for the cause. Of course any one will know on a moment's reflection, that the phenomena of the earthquakes at both places, can not be reconciled nor satisfied, by the 'slipping,' 'sliding,' 'settling' and 'readjustment' theory. This 'slipping,' 'sliding,' 'settling' and 'readjustment,' was nothing but the effect of the earthquake and not the cause. In San Francisco, the first symptoms felt by the citizens, were an upheaval, twisting, twirling, and quivering sensation. If the earth was simply 'settling,' how could it produce all these contortions? Why did it twist the railroads and water and gas pipes in two? Why did it shake into fragments San Francisco, and not Oakland? The natural foundations of Oakland is similar to San José, and its

distance from the earthquake origin is about the same. Why did it demolish San José and not Oakland? And Santa Rosa standing on ground apparently firmer than that of Oakland or San José and having somewhat a greater distance from the 'fault' was nevertheless **shaken with extreme violence.** Why was this? How could this occur from mere adjustment of rock materials? No wonder Mr. Gilbert says, 'there remain various anomalies for which satisfactory explanation has not as yet been found.' "

If nothing but a readjustment was going on, why jump across one town on the "fault" line, and shake another town 120 miles away all to splinters? The answer is not in the committee's report. But the true answer is in the cause which pushed up the new island in the Polar Sea; in the earthquake that occurred at Moscow, on the opposite side of the globe, at precisely the same time it occurred at San Francisco; in the earthquake at Socorro, New Mexico, in July; in the quake in Italy on April 19; in the quake at Valparaiso, on August 16th; in Ecuador, and Hawaii, in August, and at San Juan, Porto Rico on September 27th. But why multiply these cases any further? If you do not believe now that the same cause which erupted Vesuvius on April 8, 1906, caused all these earthquakes above mentioned in regular order, you would not believe it though one rose from the dead. As for Valparaiso, the same argument applies.

CHAPTER VII.

THE KINGSTON EARTHQUAKE—WHAT IT WAS AND WHAT IT TEACHES.

Kingston is the capital of the island of Jamaica which belongs to England and is the most important town on the island. Jamaica is situated about 100 miles south of Cuba in the Caribbean Sea. Kingston was founded by a handful of refugees who had lost their all in the destruction of Port Royal in 1692, at that time the chief city in all the Antilles. Kingston is rich in history almost from the very time when Christopher Columbus first set eyes upon what he considered an integral part of the great East Indies. It was on Monday, January 14th, 1907, at 3:30 o'clock p. m., that Kingston met its fate and went down

in history with San Francisco and Valparaiso in another awful earthquake. One thousand killed, 10,000 homeless and $25,000,000 damages. The population of Kingston is about 55,000; a great many of whom are negroes. Ten minutes after the first shock, flames burst out in the ruins and raged for three hours before any efforts were made to check them. The people, terror stricken, have fled to the outlying hills at the rear of the city and are camping there, practically without food or shelter. The government is using every effort to provide food for the homeless, but with little success, because of the terrific loss in the business section of Kingston. Among the distressing features of the entire disaster was the burning of the Military hospital in which 40 soldiers were burned to death before any effort could be made to save them. Several persons were shot by the troops who were called in to restore order after the first panic. The only foreigner of prominence known to be dead is Sir James Ferguson, ex-postmaster general of Great Britain. The shock came suddenly without warning on one of the most beautiful days of winter in Kingston. The sun shown brilliantly and the streets were crowded with natives and with tourists from all parts of the United States and Europe who sought the warm clime of the Caribbean. It had been unusually calm and warm. Suddenly at about half past three, there was a tearing and wrenching of the earth under the city which swayed and pounded vigorously for over 40 seconds. Instantly the frail walls of the buildings in all directions collapsed, burying hundreds in the debris, causing the wildest panic. Women and children ran shrieking from the houses and in a few minutes the streets were choked with a struggling mob of people fighting blindly to escape from what seemed imminent annihilation. In the mad rush women were beaten down ruthlessly and children were trampled under foot. A second, third, fourth and fifth shock followed in close succession. By this time flames had broken out in six different sections of the town and began eating their way through the ruins, and many people were roasted alive. Their cries could be heard above the roar of the flames. Pandemonium reigned supreme. Trolley and electric wires fell to the ground in one tangled mass. Horses became entangled in these wires and many were electrocuted. This added to the tumult. Many of the poorer inhabitants waited

long enough to gather together some of their more precious belongings and tried to drag them through the streets and many lost their lives in this manner. In the first shock the fire-fighting apparatus of Kingston was so badly disabled that it was rendered useless, and for three hours the fire raged unchecked. Store houses and business warehouses containing large supplies of food and clothing were licked up by the flames. The Myrtle Bank Hotel, the principal hostelry of the city and the favorite resort of wealthy tourists, was destroyed before the fire department could reach it. This hotel was famous among tourists the world over. Many notable men and women were there from Great Britain and Canada attending a conference of the cotton spinners and planters. Fortunately a great many of them were in the country at the time of the shock and escaped bodily injury, but lost all their belongings; and had to go without food and shelter like the commonest inhabitants. During the tumult which followed the earthquake, the negro population of Kingston became uncontrolable, and the police were unable to cope with them. The negroes looted houses, tore jewelry from the persons of women; broke into rumshops and becoming intoxicated ran like mad fiends through the streets. Governor Swettenham, of Jamaica, called out the troops and restored order. The glare of the flames of Kingston could be seen four miles away. Part of the city sank into the sea. Today the visitor to the island of Jamaica may see, as he gazes into the pellucid waters, the fish playing through the belfrys of the churches on one hand or swimming slowly through what was once the habitation of man. It was in 1692 that the first earthquake known to history shook into the sea the city of Port Royal. It was then the first financial city of the Antilles. The shock came early in June when the vernal equinox was much delayed. There were in Port Royal at that time probably 5,000 persons. The shock came without warning at mid-day, and silently all that was good and rich and many of the inhabitants slipped into the sea. On the outskirts of Port Royal, Kingston of today was reared. The ill-fated city has been swept many times by fearful tornadoes and cyclones, inflicting many million dollars damage. And no less has it been devastated by fire. On November 23, 1906, exceedingly sharp earthquake shocks were felt. This was only two months before the present fearful

calamity and shows plainly that it was only a continuation of the series of convulsions which destroyed San Francisco and Valparaiso only a few months before. The island of Jamaica is only a continuation of the Andes mountains which extend far down into the Caribbean sea. The same range extends up through Panama and along the Pacific coast west of the United States up into Alaska and the Polar Sea. These mountains are only the formation of volcanic upheavals from the interior of the earth in ages past in its efforts to relieve itself of the accumulated heat in the interior from pressure caused by gravitation. If we needed any more evidence to prove that the theory of gravitation is correct and that the "slipping and sliding" of the rocks in the earth is false and incorrect, the earthquake at Kingston seems to furnish all the evidence desired. Any sensible person will know that it would be utterly impossible for the rocks in the earth to "slip, break and fall in," in such a way as to cause the earth to upheave, shrivel, twist and contort so as to leave great cavities 150 miles long and 20 feet wide and thousands of feet deep in the earth. And above all, any sensible person will know on a moment's reflection that it would not take 380 of these "slippings" to settle the rock back again to a normal condition. At Kingston the bottom of the harbor has been so changed and upheaved that it is dangerous to approach it without exercising due caution to prevent disasters to steam ships. The fact is the destruction of Kingston was caused only by a submarine earthquake exactly similar to that of San Francisco and Valparaiso. They were all three caused by an excessive accumulation of heat in the interior of the earth caused by pressure through gravitation. The earth was only seeking relief from this surplus of heat, and of course the escape was made through the weakest places in the crust; and when relief came through an explosion the crust of the earth settled back again to its normal condition. No other sensible nor scientific conclusion can be reached. In the case of Kingston, 15 minor shocks were felt before the earth settled back to its normal condition. Now, to show that the earth was under a tremendous pressure at other places on its surface at the same time it was undergoing such terrible convulsions at Kingston, we give below a few press dispatches as

positive evidence. The Kingston earthquake occurred on January 14, 1907, as given above:

Stockholm, Sweden, January 10, 1907.—Two distinct and sharp earthquake shocks were felt at several points in Sweden this morning. Dispatches received from several places report that the rocking of houses caused a hasty exodus of the alarmed inhabitants.

Yekaterinburg, Russia, January 10, 1907.—Two earthquake shocks were felt here early this morning.

Christiana, Norway, January 10, 1907.—Two severe earthquake shocks were felt here at 1:30 o'clock this morning, accompanied by rumblings like thunder. Telegrams show that the shocks were felt at the other towns in Norway.

Williamsburg, Pa., January 10, 1907.—A series of shocks, evidently earthquakes, were felt and heard in this section from 4:15 to 5:30 o'clock this morning. Buildings shook so that families were awakened, and rumbling sounds were heard over an area of 20 miles.

Udine, Italy, January 18, 1907.—A severe undulation shock was felt at Tolmezzo, 29 miles from here, at 4:20 this morning. The inhabitants, panic-stricken, fled from their houses into the streets. No loss of life. Tolmezzo is situated at the southern foot of the Carnio.

Glasgow, January 18, 1907.—Two slight earthquake shocks were felt at Oban, Scotland, yesterday. No damage.

Honolulu, January 17, 1907.—The second lava flow from the volcano of Manua Loa, on the island of Hawaii, is now only two miles from the sea and is half a mile wide. It is moving at the rate of 30 feet an hour.

Honolulu, September 5, 1906.—Two earthquake shocks are reported from Hilo, on the island of Hawaii. No damage was done. After one of the shocks hundreds of dead fish were thrown upon the beaches. Apparently they had been scalded to death by a submarine eruption.

San Francisco, January 14, 1907.—A quaking of the earth's crust more severe than any one that has ever been recorded is reported to have been felt at Apia, December 21, 1906, according to a report brought from them by the Australian liner Ventura, just arrived here. For three hours the seismograph of the German scientists, stationed at the South Pacific

Island, recorded a shock that for violence has never been equaled, so far as has been registered. It is estimated that the center of the disturbance was 900 miles South of Apia. The point of disturbance was submarine.

Laibach, Austria, January 3, 1907.—The seismograph at the observatory here yesterday recorded, at 1:15 p. m., a severe submarine earthquake, 11,200 miles distant. It is stated that the distance suggests an earthquake in the South Pacific Ocean, East of New Zealand.

London, December 23, 1906.—A big earthquake of nearly three hours duration was recorded Saturday evening by the seismograph on the Isle of Wight and Aliboch, Bologne, and Florence, and a violent shock was felt in Russian Turkestan.

Honolulu, January 16, 1907, via San Francisco, January 23.—At midnight, Wednesday, January 9, the people of nearly all parts of Hawaii awoke to the realization that the splendid spectacle of an outbreak of the volcano Mauna Loa was before them. In Hawaii, volcanic activity is never dreaded; it is always welcomed. It is a most magnificent spectacle without any danger to life or property. Four days after the outbreak the stream of lava found its way to the sea. In a brilliant cataract of fire, it plunged over the cliff into the waters of the Pacific.

Seattle, Wash., March 14, 1907.—Word has been received by the Post-Intelligencer from Valdez that the volcano on the island of Akutan, off the peninsula of Alaska and not far from Unalaska, was in active eruption when the steamer Dora passed the island at 2 a. m., February 2. All the passengers were aroused to witness the sight, which is said to have been magnificent. At about the same hour, a severe earthquake occurred at Unalaska, although it did no serious damage. The natives of the Aleutian archipelago were frightened, believing part of the island would sink.

Kingston, Jamaica, March 8, 1907.—Since Monday several sharp earthquakes have been felt here. They were accompanied by a loud, roaring noise.

We could go on giving a multiplicity of earthquakes similar to the above; but we have given a sufficient number to prove unmistakably that the theory of some scientists that earthquakes are caused by faults in the earth's crust, and that

the rocks "slip, slide and fall in," is absolutely false. Before the invention of the seismograph, when only great and destructive earthquakes were known, there might have been some excuse for formulating such a theory; but since the seismographs record from 20 to 50 earthquakes every day in the year, such a theory is preposterous. How does the report of the earthquake commission of San Francisco appear in the face of the record of the seismograph telling us that from twenty to fifty occur on the earth's surface every day in the year? That commission reported that it was their belief that the rocks "slipped, broke, and fell in." Why would the earth "break, slip and fall in" from 20 to 50 times every day? How could the rocks in the earth "slip, break, and fall in" from 20 to 50 times every day? Where would they fall to? Would there not be a stopping place somewhere? After a few moments' reflection such a theory becomes not only laughable, but ridiculous. There can be but one true theory, and that is the accumulation of heat in the interior of the earth from pressure through gravitation must be relieved from time to time, and this is the true cause of all earthquakes and volcanoes and hot springs. It seems to me that this cannot be made any plainer. We will admit that earthquakes and volcanoes and hot springs are great mysteries to those who adhere to the Nebular Hypothesis; because it is false. And they will ever be mysteries to those who hold to such false theories. But to those who can comprehend the true workings of Newton's law of gravitation, and see every particle of matter in the earth, moon and sun pressing toward the center of these globes with millions of tons to the square inch, can see how earthquakes and volcanoes and hot springs in the earth are formed and how such pressure will melt the sun and ever hold it in a molten mass.

THE MYSTERY IN EARTHQUAKES.

The following is from the Cleveland Leader of April 20, 1907: "The careful study of the phenomena of earthquakes which modern science has been making in the last few years leaves the whole subject as great a mystery as ever. It is certain that the extent of the seismic disturbance need not in any degree correspond to its violence at the surface where the earthquake is centered. It is apparent that the shock or

tremor often reaches parts of the earth thousands of miles from any district where it works serious havoc. But the ultimate cause of earthquakes is still unknown. It is not determined whether they are always of the same origin or due to wholly dissimilar forces, which is more probable. There has been nothing in the recent study of such convulsions of nature to justify any attempt to foretell their coming or limit their scope. If anything, the tendency of modern research is to widen the possible earthquake area. It seems rash to assert positively that they can never take place in some parts of the globe which were formerly counted permanently immune. There is no evidence which warrants the hope that the earthquake danger is lessening, taking the world as a whole. As great disturbances are possible now as at any time since history began. Long ago it came to be the common belief of students of natural phenomena that there was more or less connection between earthquakes and volcanoes, and that theory is strengthened by the latest disturbances of a seismic nature."

Most of the above article is scientifically sound; but certain expressions are erroneous. To intimate that earthquakes are ever caused by dissimilar forces is erroneous. To say that all recent study and researches leaves the whole subject as great a mystery as ever is erroneous. To those who hold to the old theory of the Nebular Hypothesis, and that the earth is cooling off or drying up or losing any of its air, water or energy, "the whole subject is as great a mystery as ever," because the ultimate cause of earthquakes and volcanoes and hot springs can never be answered nor solved by that theory; but to those who can understand the true workings of the law of gravitation the whole subject is already solved. To those who will study these pages in this book, the whole subject will become very plain. There is no other way to solve these seeming mysteries except through the law of gravitation.

VESUVIUS IN FURY.

Hardly since Martial sang and Pliny the younger wrote of the great eruption of A. D. 79, which destroyed the cities of Herculaneum and Pompeii, has there been such a catastrophe as this year has visited the beautiful Campania. Their words read like a description of the horrors of today; 193,000 acres

of lately twining vineyards, cultivated lands, and beautiful forests just bursting through the buds of springtime, which with some of the villages near the crater, lie smoking in utter destruction; or buried under one or two meters of pumice-stone. The present eruption, though one of the most terrible on record, is not quite up to the pitch of horror which the younger Pliny describes as accompanying the earlier eruptions, although many of the incidents related by him of that great catastrophe have been repeated this year. The same enormous cloud, which Pliny likened to a gigantic "pine-tree," shot up to a great height, and spread itself out at the top in branches. Again it shrouded the whole vast gulf and the great region round about the mountain was covered with a great blanket of cinders and pumice-stones and black chunks of burning rock, while whirling flames shot out from many places on the mountain. The terrible earthquake and the roaring, rolling sea, retiring from the shore, were lacking in the last great convulsion; but darkness that might be felt hovered over various points about the bay, spreading horror and gloom on all sides. This phenomenon was noticed 20 miles away for an hour or two. It created great alarm among many of the foreign visitors, and on the steamers making for the port of Naples, causing many to turn back. For a whole day the port was inaccessible on account of the cinders darkening the air. In half an hour the streets of Naples were filled to the depth of six inches with a soft, powdered material like ashes. The inhabitants did not seem to be seriously alarmed, except the inmates of the prisons, who rebelled and had to be subdued by the troops. The streets, however, have been filled with religious processions carrying the effigies of their patron saints and imploring aid. The people entered the cathedral and took forcible possession of their patron saint, and fully 30,000 people escorted the sacred bust of St. Januarius to the confines of the city nearest the mountain. The towns lying round the mountain sides were deserted and some of the smaller villages near the cone were destroyed. Here the awful scenes reported by Pliny were repeated. A hideous darkness reigned, lighted up now and then by monstrous streams of lava pouring down from the central cone and from vast cracks in the sides. From time to time new craters would burst forth, exploding with a

tremendous roar, threatening to sweep everything before them. In the doomed upper villages the rain of cinders became a downpour of volcanic sand mixed with large pumice-stones and large masses of molten matter. In the outlying regions of San Giuseppe on the northeastern slope, the people fled through this awful hail of projectiles, protecting themselves with tables and chairs, held above their heads. "The Last Days of Pompeii" were repeated, with husbands, wives and children calling through the darkness for each other. Many were carried to places of safety; but the 150 who had fled to the church to pray for heavenly aid were buried beneath the roof when it fell, from the weight of material which fell upon it. A larger number died in their own houses, unwilling to leave their homes. This village of San Giuseppe, and the larger town near it, resemble the partly excavated Pompeii, the pumice and the sand reaching nearly to the tops of the lower houses. The smiling vineyards lie buried two yards deep beneath the sand and cinders. When the worst was over, the people at once came back, and the streets were full of returning fugitives, seeking their lost homes or the bodies of their dear ones. Tens of thousands of refugees had to be fed by Naples and the surrounding towns. At one house which had been entirely surrounded by the flood of lava, but was not destroyed, people were seen on top of the mass, entering the upper windows with a ladder, securing their household goods and transporting them to places of safety. Yard by yard the lava swept onward—presently a palatial villa would be surrounded by the torrent, overwhelmed and disappear in smoke. Presently a weeping peasant would see his little cottage and vineyard, all he had on earth, go under in an instant. One poor woman was watching the destruction of her earthly belongings, from a little hill, when a smaller crater came roaring forth under her very feet. She turned to flee, fell and rolled to the bottom of the hill, and the next moment the lava poured forth like the foam from a glass of beer and totally overwhelmed the spot where she had stood an instant before. In A. D. 79, it was the shower of pulverized material that destroyed Pompeii, and the overflowing lava that overwhelmed Herculaneum. This circumstance is what makes it easy to dig out Pompeii, but next to impossible to excavate the finer city,

Herculaneum. Naples has suffered great inconvenience by this eruption, because of her streets being laden with ashes five or six inches deep, at times crushing in the roofs of buildings and killing many people there. There have been many splendid instances of heroism and devotion to duty in this great eruption of Vesuvius, as well as in the great earthquake that destroyed San Francisco. Prof. Matteucci, at the observatory near Cook's railway, has elicited the applause of Europe. The brave scientist stood at his post together with his American coadjutor, Mr. Frank Perret, though the observatory itself was shattered and the power-house of the railway was swept away. The cause of this eruption is said to be local, due to the evaporation of sea water coming in contact with the incandescent mass in the mountain. The damage done at this eruption is estimated to be: 193,000 acres of tillable land, estimated at $12,000,000. This eruption has been much more severe than the one of 1872, or any other recent one. Prof. Matteucci says that the present eruption began, not on the 7th or 8th of April, 1906, but on the 27th of May, 1905, when the eruptive mouth opened on the northwest of the crater. The loss of property in houses, crops, trees and land will far exceed any eruption for centuries. Very extensive tracts of tillable land will not be again productive for centuries. The whole region during the eruption was covered all the time with a dense pall of smoke and powdered dust, through which nothing could be seen except the terrible flashes of lightning which seemed to pervade the earth and sky. This lightning was incessant, and accompanied with horrible roarings, which, mingled with the increasing bellowings of the crater, made a scene of terror that might well be compared to the descriptions of Dante's Inferno. Yet such was the unquestioning faith of the peasants in the protective power of their saints that they confronted the monstrous serpents of lava sweeping down on their homes, almost as calmly as if they were watching the progress of a railroad train, till the implacable nature of their deadly enemy dawned upon them. Now, the description given of the eruption of Vesuvius is similar, to a great extent, to what occurs at the crater of all powerful volcanoes.

It is interesting to read this, and, having read this, you have read what occurs at the vents of all volcanoes. A descrip-

tion of any other activities at the craters of other volcanoes is only a repetition of what occurred at the crater of Vesuvius in the above narrative. Any other description of any other volcanoes can differ only in form and intensity, and not in kind; for all are alike in nature. The above description only tells what occurred, and does not tell why it occurred; or, in other words, does not give the cause of the eruption. Now, referring to the infidelity and paganism of the peasants, and to observe the faith they have in their saints to prevent the horrible destruction of volcanoes, one would naturally come to the conclusion that it is not surprising that the true cause of earthquakes and volcanoes has been deferred to this good day. One would think that they had never heard of God or Christ. The habit of so many scientists trying to account for all natural phenomena by simply referring it to the laws of nature, leaving God entirely out of the question, has had no little to do with causing infidelity and spreading it among the people. The laws of nature—what are they? Nothing but God's invisible hand in everything. If this is not so, we have no God. If we have a God "He is all and in all." "The cause of this eruption is said to be local, due to the evaporation of sea water coming in contact with the incandescent mass in the mountain." In one sense this is true, and in another it is not. The real cause of the eruption lies much deeper than the fact of sea water coming in contact with the incandescent mass. What made the incandescent mass? Where did it come from? Was it created when the earth was, or has it been developed since? How did it come to be in the mountain? Now, you see we must answer all these questions to get at the real cause of the eruption of Vesuvius. Now, the eruption on April 7th and 8th was nothing but the mechanical operation of the sea water and molten matter coming together—the effect and not the cause of the eruption. It will not do for us to say that the molten mass in the mountain was created when the earth was; otherwise we would have to answer why it did not blow out long ago in some other eruption, as Vesuvius has been in eruption for 2,000 years, to our certain knowledge, and probably for ten times two thousand before the historical period. We must account for the phenomena in some other way. It will not do for us to try to account for this molten mass on the

theory of **chemical action,** which was advocated by Davy many years ago, and which was beset with so many inexplainable difficulties that he abandoned the theory himself as inconsistent with the facts. It will not do for us to try to explain the existence of this molten mass on the theory of "radioactivity," which has been recently launched by Major Dutton, for this theory is nothing more than a revival of the old chemical theory advocated and abandoned by Davy many years ago. There is one thing certain: this molten mass or incandescent heat is developed from time to time, or is developing all the time. Then there is a cause for this development of heat in the interior of the earth. This **cause** is the **friction** of the **particles** of the earth by the tremendous pressure produced by **gravitation** upon every particle of matter in the earth as the square of the distance. We have already shown that heat increases on an average of about 1 degree Fah. for every 54 feet as we descend into the earth. This fact is indisputable. Now, the heat, according to God's law of gravitation, in every planet including the sun, is in proportion to the amount of matter in that planet. This is why the sun is incandescent and remains so. Increase the size of the earth to the size of our sun, and the earth would become a sun. The sun is 1,300,000 times larger than the earth and 500 times larger than the balance of the whole solar system. So, increase the power of gravitation on the earth 1,300,000 times and the intense pressure would melt the earth into an incandescent mass and keep it forever melted until the pressure from gravitation is removed. This is the very cause that keeps our sun in an incandescent condition, dispensing light and heat and magnetism in all directions to the worlds dependent upon it. Every one must know that the sun is controlled and actuated by some special, continual, constant law; otherwise it would burn out. The misconception that many astronomers have in regard to the replenishment of the sun, is the reason why some have suggested that the sun may burn out. Far from it. When God created the sun He created a law—**gravitation**—by which the sun is ever replenished, and will continue to burn on through eternity if it is His will to do so. The great difficulty in arriving at the true cause of earthquakes and volcanoes is, scientists have been always laboring under a false conception in regard

to the creation of the world. They try to explain everything by leaving out the Creator. They are generally hammering away on the effect and not the cause. All the above article does is to relate the effect, in telling how lava poured out, and how it run down the sides of the mountain, covering up houses, towns, vineyards, forests, and sending up smoke like a "pine-tree." Now, all this reveals nothing concerning the true cause. We must elevate our minds above these little manifestations of God's power and get into the higher elements of creation, and place the sun in the center of our solar system, where it properly belongs, and place the planets in their proper places, only little, dependent creatures on the powerful luminary, who holds them in his grasp as a little child swings his ball over his head at the end of a string. When we are able to do this then we will begin to form proper conceptions of all created things, and that there is only "one God, one law, one element." In another chapter, and at another time, we will be able to show that every convulsion in the sun produces a corresponding convulsion in the earth. It could not be otherwise, if the earth is a member of our solar system, and controlled by the law of gravitation, the same as all other planets and even the sun himself. Then our **definition** of the **cause** of the **late eruption** of Vesuvius, and all other volcanoes, is this: **The eruption is caused by an expansion of excessive heat generated by pressure produced by the law of gravitation in the interior of the earth, which expansion coming in contact with water, and other gaseous substances, causes an explosion.** Now, we are aware of the fact that the sun exerts a modifying effect over these convulsions of the earth in earthquakes and volcanoes, in causing them to occur sooner or later, and more frequent in winter than summer, as is shown by carefully prepared statistics. And the moon also exerts certain influences which modify the conditions under which they occur. These will be shown in a later chapter.

CHAPTER VIII.

THE CAUSE OF EARTHQUAKES.

The following, taken from the People's Encyclopedia of Universal Knowledge, will give a partial idea: "An earthquake is any tremor or shaking of the solid crust of the earth. The frequent occurrence of earthquakes, their destruction of life and property, their influence upon the solid surface of the earth, the mysteriousness of their cause, force them upon our attention. It is estimated that 12 or 13 earthquakes, destructive more or less to life and property, occur every year. It is well known that the surface of the globe is never free from sensible evidence of the continual operation of earthquake agencies. When these are of a serious nature whole cities have been destroyed. No less than 60,000 people perished in the great Lisbon earthquake, while in that of Calabria, in the end of the 18th century, 40,000 people were destroyed. It is estimated that 13,000,000 of the human race have thus perished. No portion of the earth's surface is exempt from the influence of earthquakes. Egypt has been less visited than perhaps any other country, but even here we have the record of one that took place in 1740; and Holland, with its loose alluvial deposits, has also felt their power. All theorists are agreed as to the connections between volcanoes and earthquakes—that they are produced by the same subterranean agency. The existence of molten matter in the interior of the earth is the starting point in all except that of the 'chemical' theory produced by Davy, which, though in the end abandoned by him, finds supporters still. The earth is believed to be of a honeycombed structure and the cavities contain, in many places, lakes of molten rocks, between which and the surface are volcanic orifices of communication. Into these cavities water sinking down through crevices from the ocean or the land must be constantly finding its way, and the steam then generated exerts such an enormous pressure as to force the molten matter to the surface, itself mingling and escaping along with it. When a mass of water is suddenly precipitated into a hot cave the

explosion of steam will cause an earthquake concussion, and where there is no vent may be sufficient to convulse and rend the earth." This is the best definition, and indeed accords with more of the known facts than any I have seen, and I have read from Spallanzani, and Poulett Scrope, to Dutton; but it is defective in some points. For instance: "The earth is believed to be of a honeycombed structure and the cavities contain in many places lakes of molten matter (rock) between which and the surface are volcanic orifices of communication. Into these cavities water sinking down through crevices from the ocean or land must be constantly finding its way and the steam thus generated exerts such an enormous pressure as to force the molten matter to the surface, itself mingling and escaping along with it." How could the earth be a honeycombed structure with such a tremendous pressure as it has to endure all the time from without from the law of gravitation? Would these cells in the honeycomb be full or partly so? If full of molten rock, what must the sides endure in temperatures, and how could water get in to create an explosion? If they are not full of molten rock, how could the empty chamber above withstand the pressure which is estimated to be millions of tons? If the water should get in, as stated, and be converted into steam, would not the steam stay on top instead of at the bottom of the molten rock, as it does in a boiler of a steam engine? How were these volcanic orifices made? If these supposed lakes of molten rock are once erupted should they not remain so? How does it happen that Vesuvius has been refilled time and again for over 2,000 years? Such questions as these suggest themselves, and must be answered, or the theory on which they stand is absurd. Now, we get into just such a predicament every time we undertake to reason from the Nebular Hypothesis, which is in itself wrong. The earth never was a ball of fire, never did cool off and wrinkle and twist and contort in such a manner as represented —causing lakes of molten matter to be left in pools standing here and there in all parts of the earth. The very actions of Vesuvius, if we had no other volcano on the earth, disprove this theory. Vesuvius has made hundreds of eruptions at different times, and no less has Etna. Did not Vesuvius at one time sleep 351 years and then come forth as powerful as ever?

Did not Etna at one time sleep 500 years and then come forth as great as ever? The affirmative answer to these questions upsets the honeycomb-pool-theory. Now, then, how are we to answer these questions and set up a consistent theory that will stand the test of all time and fill every contingency in every case? The answer is simple: Gravitation being a constant force, by pressure of every particle of matter of the earth toward the center, produces heat sufficient all the time to answer all these phenomena. The water is already in the earth; it does not have to trickle down through the rocks to "mix and mingle" with the molten mass. It gets hot under pressure the same as rocks and other materials; and gets hot at the same time. Dig where you will and water is abundant, and if you dig deep enough you get plenty of hot water—artesian wells. Then what's the use of all this "hue and cry" about how the water gets to the molten mass of rock in order to make an explosion which causes the earth to quake and the mountains to be set on fire. All these erroneous theories come about by assuming that the earth was at one time a molten mass—a ball of fire. In the first chapter of Genesis this theory is disproved or the Bible is a lie. It says, "In the beginning God created the heaven and the earth and the earth was without form and void. And darkness was upon the face of the deep. And the water covered the earth. And God said let there be a firmament among the waters, and it was so. And He divided the waters from the waters and dry land appeared." How does this correspond with the molten-mass-ball-of-fire-theory? The only great question to settle concerning the real cause of earthquakes and volcanoes is in regard to how the heat is generated in the interior of the earth. Of course, every sensible person knows that without heat we would never have an earthquake nor a volcano, no matter how much water was in the earth, with the single exception of artificial earthquakes caused by an explosion of some kind on the surface. Then the generation of heat is the main question. The law of gravitation, discovered by Sir Isaac Newton, fully answers that question, and the application of water or gases or other elements is only a secondary consideration. Of course, it is a natural law for heat to expand. It is also perfectly natural for water to be converted into steam when heat is applied. Gases also

expand by the application of heat. So, we might sit around the mouth of a volcano all our lives and watch the result of these combinations and see thousands, yes, millions of tons of lava pour forth and yet learn nothing concerning the first cause that produces them. When we find the true cause that produces the heat, the problem is solved. Gravitation fills all the conditions in the problem. It has been a great stumbling block in the way of some geologists to solve the problem how the water in the fissures of the earth can mix with the molten matter and at the same time not be blown back through its own channel. Under the proper conception, this problem is easy. Do you suppose that a molten mass of liquid hot fire, five or six thousand miles in diameter, could possibly, under any consideration or condition, remain tranquil or placid? Would it not be subject to the same influence under the law of gravitation as water now is on the surface of the earth? Would there not be upheavals and depressions in the molten liquid mass, the same as on the ocean, caused by the attraction of the earth and moon? Besides, would not the rotation of the earth on its axis have a tendency to cause the molten mass to revolve around the center of the earth? Admitting this, which is a self-evident fact, of course the water coming in contact with the moving molten mass would be carried forward instantly to other points where there are vents and being converted instantly into steam would "mix and mingle" with the molten mass until relieved at some other point in earthquakes and volcanoes. Some geologists reject the molten mass theory because Vesuvius has discharged different kinds of lava at different eruptions. Is not this exactly what we should expect from a moving, revolving mass in the interior of the earth? Gravitation solves every condition in the problem. Now, admitting the **theory of gravitation** as proved, there are conditions in every earthquake and volcanic eruption to be accounted for solely on the different formations through which the lava has to force its way toward the surface. For instance: the force that shattered San Francisco from below, pressed its way through stratified rock which no doubt lies in curved lines, and the seismic shock that exploded under San Francisco, was no doubt several thousand feet nearer the surface of the earth than the vein of lava that exploded under Oakland and other

towns. This accounts for the terrible destructions of some towns and others scarcely moved in the same district where the earthquake occurs. Suppose, for instance, that San Francisco is situated on top of a stratified layer of curved rock whose projection is ten thousand feet higher than the dip; and suppose that Oakland is situated over this dip which is filled with earth material which levels it up to the surface of the earth, it is very evident that a vein of lava pressing its way, probably horizontally between these curved strata coming in contact with more water the further it goes, when it reaches a stage of explosion, would be ten thousand feet nearer San Francisco than Oakland, and of course the shock would be much greater at San Francisco than Oakland. This is the anomaly that I suppose Mr. Gilbert referred to as yet "not being accounted for." Of course, it cannot be accounted for, under the supposition that the underlying rock broke, slipped and fell in. The cracks in the earth at San Francisco and other districts visited by earthquakes are caused by the uneven upheaval and twisting and writhing of the underlying rocks settling back after having been upheaved by the subterranean power. It is very dignified to sit back and write "that the earth reached another stage whereby further settling was possible;" but to bring the proof is quite another question. It has never been produced up to this good day. Of the 30,000 earthquake shocks that occur each year, about 60 are "world-shaking," giving instrumental records at a great distance; and Prof. John Milne finds that these great earthquakes belong to thirteen regions, three being unimportant. The important centers form two great rings, with a radius of 65 degrees, embrace seven regions: the Alaskan coast, the California coast, the West Indies, the Chilean coast, the islands of New Zealand, Krakatoa and Japan; and the other with a radius of 50 degrees from its center in the Sahara desert includes the earthquake regions between India and Madagascar, the Azores and Tashkand. Prof. Sollas has concluded that the earth has the shape of a pear, its ends being the centers of these two rings, one in Africa and one in the Pacific. This view has had remarkable confirmation, and the weakest points of the earth's crust are where the theory would suggest.

How accustomed we are to think of the surface of the

earth as being stable. How seldom we realize that it is a mere crust or shell which is only thick in comparison with the little creatures who dwell upon it. We consider it firm because it is firm to us, except in some places or on infrequent occasions. When it is disturbed and there is a dislocation of only a few inches, the works which man has laboriously piled up on the area affected tumble into ruins. A sudden or lingering death may be the fate of thousands. The great convulsions of nature appear to men to be uncommon and infrequent; that is because the span of human life itself is so short. The life of the oldest man does not encompass many fearful volcanic eruptions or earthquakes. Comparatively few men have a personal experience of any of them. But they are occurring almost uninterruptedly at some point on the earth's crust. They differ only in degree, not in kind. As volcanic eruptions sufficiently show, this planet is not the immovable mass which our imaginations would depict when comparing it to the atmosphere which surrounds it, or to the ever moving waves of the ocean. On the contrary, the ground on which we tread vibrates very frequently. Without alluding to these great shocks, which overthrow cities, tear down the sides of mountains, and open vast cracks across plains, as occurred at San Francisco on April 18, 1906, there are other less violent vibrations which are now recorded by many seismological instruments of recent invention, that only a few years ago could not be recognized at all. Before the invention of the seismograph and magnetograph, thousands of vibrations of the earth's crust passed by unnoticed; but now the slightest oscillation is noted and recorded instantly. The earth is known now to be in a constant state of vibration. It is exactly represented in the nervous system of the human body, and has as many, in comparison to size, veins and arteries through which creeks, rivers and streams of all sizes circulate; and in addition to these it also has caves, hollows, wind currents and gas currents that mix and mingle with the water currents, causing constant vibrations in all parts of the earth. The earth being an organized body, must of necessity have ventilation; and this ventilation is carried on through earthquakes and volcanoes, hot springs, geysers, steam jets, gas jets, and mud jets all over the world. Evidently an erroneous opinion exists among scientists as regards the condition of the molten mass in the interior of the earth.

According to this theory of gravitation, which is substantiated by actual experiments, the heat would increase as you descend toward the center of the earth in something near a regular order. It has been thoroughly established in borings, in mines, in artesian wells, and in other ways, that the heat does actually increase about 1 degree Fah. for every 54 feet as you go downward. Now, then, there would be a gradual increase of heat toward the center of the earth; but there would not be a well defined limit where the rock or earth material would suddenly jump into a molten mass. The heat increases so regularly and so quietly that from the surface of the earth downward the earth material would pass through all grades of consistency from the solid outer crust, through tough wax and elastic putty, soft dough, and then land into a flowing liquid molten mass at the center. You might consider the earth "honeycombed," but the mouths, or openings, would be turned downward. The molten mass in the interior fills all the cells whose mouths are turned downward, and some of these cells would necessarily extend miles further up through the mass than others; some causing earthquakes, some causing volcanoes. Hence, Humboldt's suggestion that an earthquake would be "the reaction of the liquid nucleus against the outer crust," would be correct. Right here, I think, is where the most of the scientists fall down, by imagining that the outer crust is a well defined shell, perfectly slick on the inside like an egg-shell. Nothing could be more erroneous from the very nature of the constituent elements of the earth. There must be hard places and soft places for a considerable distance as you go downward, as it is thoroughly known that all substances do not fuse alike. In all the earthquakes and volcanoes it is about as certain as anything can be that the earth is only seeking ventilation; and in doing so causes these great convulsions. It is a well established fact that districts contiguous to volcanic mountains are more frequently shaken by earthquakes than others more remote; but this is caused by the rushing of great quantities of heat and molten matter to these already-formed vents; for it is perfectly natural for all forces to rush out by the way of least resistance.

All the heat that is constantly accumulating in the interior of the earth, by pressure from the attraction of gravitation,

must escape sooner or later by some process; but some parts of the earth may withstand the pressure much longer than others—some districts may withstand it for hundreds, and some for thousands of years; but the longer it is pent up the greater will be the explosion when it does come. In South America, most of the great shocks have taken place in the region of the Andes, or not far from their base. The theory that every earthquake not followed by an eruption, as stated by Mr. Mallet, is only an "incomplete effort to open a volcano," is hardly consistent with the facts; for a lava stream may force its way up through vast layers of rock, and at a certain point be turned aside and spread its current horizontally in several directions and press its way thousands of miles between layers of stratified rock before it accumulates enough steam and, of course, force, to cause an explosion or earthquake. These streams of hardened lava have been seen in many regions of the earth, where rivers and oceans have washed away sand and dirt and left the great mass of stratified rock exposed in great columns, in bluffs and mountain gorges. Some scientists seem to be puzzled in regard to the connection of some earthquakes and volcanoes, and some volcanoes with other volcanoes, and cannot quite understand how it is that some are quite independent of others in nearby districts, while others seem to be closely connected. The proof is not wanting in many instances where the sympathetic influence causes two or more volcanoes to give out an eruption at the same time. Likewise, we have various instances where an earthquake caused volcanoes hundreds of miles away to cease their eruptions instantaneously. No less authority than Mr. Humboldt tells us that at the time of the earthquake at Lisbon, Vesuvius, which was erupting a considerable amount of vapor, suddenly sucked in the cloud which it was throwing out, and that the current of lava which was flowing from its sides suddenly stopped. And that the volcano of Pasto, having been in eruption for three months, throwing up a very high column of smoke, ceased to throw out vapor at the exact moment when, at a distance of 250 miles, the earthquake of Riobamba and the mud-eruption of Tunguragua caused the death of 40,000 Indians. It is also said that Stromboli relaxed its incessant activity during the Calabrian earthquake in 1783. Some volcanoes go into a stage of activity

without, so far as we can see, causing an earthquake; but new volcanoes, or those having been dormant for a considerable time, always are preceded and accompanied by earthquakes. It is said that Vesuvius did this in May, 1855; but it had not been dormant long, and the vent was probably free from hardened lava of previous eruptions. To our mind, there should not be any difficulty in accounting for these phenomena at all. The earth being "honeycombed," with the cells or mouths turned toward the center, the lava is free to rise up through these cells; and the walls, or partitions, may be solid between some of the cells, while in others there would be holes or openings or cracks, through which the lava of one vent would communicate with the lava in another vent, or probably two or three or more at the same time; whereas, if the walls of these vents were solid and unbroken, or if the water coming in contact with the lava far above these cracks or holes, it is perfectly consistent for one volcano to erupt close by another and yet not interfere with it in the least; whereas, if these vents were connected by holes or cracks, it is perfectly consistent for both or all of them to erupt at the same time.

And yet all are connected with the central molten mass, but not in the way that some scientists imagine; for the interior of the earth is not smooth like the inside of an egg-shell; but from the nucleus at the center, which is 4,000 miles away from the surface at most places on the globe, where the heat must be "white-hot," every degree of temperature would be met with in coming outward till we reach the surface. This waxy, putty-like condition of the interior of the earth up near the hardened crust, will account for the upheavals and depressions of the continents which is going on all the time. Of course, the intense heat under this waxy, putty-like condition of the upper part of the molten mass would keep it in a constant commotion, causing some parts of the earth to be elevated while other portions would be correspondingly depressed. So, the theory of universal gravitation, and the individual gravitation as concerns the earth, will answer the upheavals and depressions of the earth's crust as well as answering every condition of earthquakes and volcanoes.

Prof. Reclus does not think that all earthquakes are caused by the same force that produces volcanoes; nor that all earth-

quakes are produced by the same cause; but he will have to bring forward other proof to substantiate his contention before the question will be granted. He says, "In September, 1814, near Alais, for twenty-four hours a series of detonations were heard like a cannonade, and then after a formidable cracking noise the ground sank 13 feet for a breadth of more than 88 yards." Now, we would like to ask what "this series of detonations going on for twenty-four hours" were? This went on for twenty-four hours before the "formidable cracking noise." Was the earth getting ready to fall in? It would seem so. Of course, it was a subterranean earthquake, pure and simple, and the falling in was nothing but the effect of the seismic disturbance. In 1811, just three years before Mr. Reclus relates his circumstances, there was an earthquake whose center was somewhere under the Mississippi River, but was felt more or less throughout the Southern States, and a hole fell in, in West Tennessee, 6 miles wide and 18 miles long, and is now known as Reelfoot Lake. Of course, it will take no great stretch of imagination to conceive that if great caverns could possibly be formed very far down beneath the earth's surface that the force of gravitation, pressing every particle of matter in the earth with a pressure of millions of tons to the square inch toward the center, would smash this cavern as soon as formed. Large caverns cannot exist very long far beneath the earth's surface. This is self-evident. The outside material of the earth is constantly pressing toward the center, and all eruptions of volcanoes are instantly filled below by other material rushing in. Writers on earthquakes are prone to give to them the geological importance in proportion to the people killed and the amount of damage done. The shock which shakes a whole city from its foundations, where thousands of individuals are assembled, may cause a most terrible disaster, while a more violent one felt only by a few in a sparsely settled country will be passed over unnoticed. But it is nevertheless true that sudden shocks which overturn cities in a few seconds are the most frightful catastrophes that can be imagined by man. All other disasters are announced by some previous signs. Streams issuing from volcanoes advance slowly, and even the approach of the terrible volcano is announced in thunder tones and earthquake shocks; and rivers

threaten the embankments long before they break through. Even the hurricane is preceded by atmospheric signs, but the earthquake comes upon us suddenly, unwarned, without any preliminary signs whatever, and in a moment's time whole cities are demolished and thousands of lives are crushed out. The earthquake at San Salvador only lasted ten seconds, but in that short time destroyed the town. The successive vibrations, which devastated Calabria in 1783, were felt during barely two minutes. The terrible movements which destroyed Lisbon succeeded each other during the space of only five minutes; but it was the first shock, lasting only five seconds, that caused the great damage. The shocks in Sicily, in 1693, and Calabria, in 1783, must have caused, in these two countries, the death of 100,000 people. Some towns near the sea shore suffer really more from ocean waves produced by the shock than from the earthquake itself. Many cities have been entirely engulfed in this way, and all the people who were not killed by the shock were drowned.

It matters little to us how fast the seismic wave travels, or whether the motion is upward or downward, or sidewise, or in a rotary manner, it is always sufficient to cause death and destruction when in a violent form; but we should know the cause, if possible, and the condition and kind of buildings that withstand the shock with the least damage to life and property. It is a widely spread opinion which has not as yet been undeniably confirmed, that animals manifest the greatest uneasiness at the approach of an earthquake. In some countries where earthquake shocks are frequent care is taken to observe closely the ways of domestic animals in order to detect the least indication of the coming shock, in order to prepare for danger. It is said, before an earthquake mice, rats, moles, lizards and snakes frequently come out of their holes and run hither and thither as if in great terror. Even the crocodile has been known to leave his marshy home and hasten to dry land, roaring with fear. At Naples, it is said that ants left the underground passages some hours before the earthquake of July 26, 1805, and that the grasshoppers crossed the town in order to reach the coast; also that fish approached the shore in shoals. During an earthquake all animals seem to be very much excited. At the time of the earthquake which convulsed

the Valley of Viege in 1855, the wild birds which most dread man, such as owls, hawks, woodpeckers, and peewees, collected on the trees close to the dwelling houses and uttered plaintive cries as if to implore divine aid. Birds of long flight, such as swallows and others, left to parts unknown at once. For several days, also, frogs ceased their croaking. It would seem from this that dumb animals are endowed with greater instincts, for forecasting earthquakes than man. From time immemorial it has been positively asserted by the people who live in countries most frequently visited by earthquakes, that these convulsions bear some intimate relation to the movement of the atmosphere, and very generally coincide with certain meteorological conditions, such as rainy seasons, numerous storms, damp and warm winds. Nevertheless, most geologists considering these disturbances of the ground to be nothing more than the half exhausted quiverings of the great ocean of fire, have recently denied the possibilities of any such coincidence. In the year 1834, Prof. Merian, having classed according to their appearance, in the various seasons of the year, 118 earthquakes, which occurred at Basle and in the countries around it, ascertained to the surprise of the scientific world, that these phenomena are much more frequent in winter than in summer. This fact, which was at first questioned, has since been undoubtedly established by the investigations of Alexis Perry and Otto Volger. Following is the monthly distribution of 656 earthquake shocks in France:

TABLE I.

January	83	July	47
February	64	August	40
March	53	September	50
April	55	October	48
May	42	November	60
June	36	December	78

TABLE II.

Following is the monthly distribution of 1230 earthquakes in Switzerland:

January	150	July	40
February	143	August	47
March	138	September	117
April	110	October	111
May	58	November	85
June	54	December	168

TABLE III.

Following is a monthly distribution of earthquakes in Mid-Valais:

January	32	July	1
February	16	August	0
March	4	September	1
April	0	October	6
May	0	November	5
June	0	December	24

TABLE IV.

Following is the monthly distribution of 98 earthquakes in the Southern States.

January	44	July	1
February	11	August	0
March	9	September	0
April	1	October	0
May	1	November	1
June	1	December	20

It is also known that earthquakes are more frequent at night than in the daytime.

Following is the distribution of 435 earthquakes every other hour for Switzerland:

TABLE V.

Night.		Day.	
12 to 2	49	6 to 8	31
2 to 4	55	8 to 10	31
4 to 6	43	10 to 12	36
6 to 8	26	2 to 4	27
8 to 10	62	4 to 6	31
10 to 12	68		

In all earthquake regions this is uniformally the case. In Switzerland, out of 502 earthquakes, the date and time of which are known, only 182 took place between 6 o'clock in the morning and 6 o'clock in the evening; 325, nearly double, were felt during the 12 hours of the night. Looking at it in a certain way, mid-day is summer and midnight is winter in each rotation of the earth on its axis. Then, from the regular fluctuations of subterranean forces, with the change of seasons and hours, we are compelled to admit, that these great events, depend, at least to a certain extent, on some external force, and not altogether on the tremblings of the internal sea of fire.

The greater number of earthquakes, then, are essentially connected with the conditions of climate; and climate depends to a certain extent upon the relative positions of the earth with all the other planets; especially, with the sun. We are driven to this conclusion by a force of circumstances that are irresistible.

Following is a monthly distribution of 2249 earthquakes in Europe:

TABLE VI.

January	363	July	238
February	298	August	258
March	284	September	238
April	254	October	287
May	280	November	352
June	227	December	320

Hurricanes are also connected with earthquakes. During the severe hurricane of the West Indies, the earth shocks are sometimes very violent. In 1844, during a severe hurricane, which destroyed hundreds of vessels in the roads of Havana, a shock, which was not in any way connected with any volcanic eruption shook the ground of the island severely. Under the theory of gravitation it is easy to explain how these electrical storms are connected with earthquakes—the same attraction of gravitation which causes the sun spots in the sun, also influences earthquakes, volcanoes, and hurricanes.

USE OF SEISMOGRAPH MAY AID IN SOLVING THE PROBLEM OF FORECASTING EARTHQUAKE APPROACHES.

On the observatory campus at Berkeley, California, is now installed a seismograph designed by Prof. Omori, of Japan, to record the preliminary motions and after-shocks incident to an earthquake. The instrument demonstrated its worth when Prof. Champerean was able to compute from its records almost the exact distance from the university of the shock at Valparaiso. Prof. Omori believes that eventually, the machine will aid in solving the problem of predicting the coming of an earthquake. The instrument belongs to the imperial earthquake commission of Japan and a receipt for the instrument has been forwarded to the commission by the secretary of the university in accordance with Omori's request.

FOLLOWING IS A TABLE GIVING THE WORLD'S GREATEST EARTHQUAKES.

Earthquakes are among the most common phenomena on the earth. It is estimated that from 20 to 50 occur on the earth's surface every day; and about 30,000 a year, 60 of which shake the entire globe. Fortunately, however, the vast majority of them are very slight. Following are the most destructive:

A. D.

63 Herculaneum and Pompeii partially destroyed by violent shock.

105 Four Asiatic, two Grecian and two Galatian cities overturned.

358 Nicodemia destroyed with all its inhabitants.

557—Thousands perished in Constantinople.

742 Over 500 towns destroyed in Syria, Palestine and Asia with awful loss of life.

1137 At Catania, Sicily, 15,000 buried in the ruins.

1158 In Syria, 20,000 perished.

1186—A Calambrian city and all its inhabitants overwhelmed in the Adriatic Sea.

1268 In Cilia, 60,000 perished.

1456 Naples, 40,000 killed.

1531 Lisbon, 30,000 buried in the city's ruins.

1596 Thousands perished in Japan.

1626 Thirty towns near Naples destroyed and 70,000 killed.

1667 At Schamaki, 80,000 perished by the shocks in three months.

1682 Port Royal, Jamaica, destroyed; 3,000 killed.

1693 Fifty-four cities and towns and 300 villages destroyed in Sicily; 100,000 lives lost.

1703 Jeddo, Japan, ruined; 200,000 killed.

1716 At Algeirs, 20,000 dead.

1731 At Pekin, 100,000 swallowed up.

1746 Lima and Calloa demolished; 18,000 killed.

1754 At Grand Cairo, 40,000 killed.

1755 Kaschan, North Persia, destroyed; 40,000 killed.

1755 Lisbon practically wiped out within 8 minutes. Upward of 50,000 perished in the ruins and by being engulfed by a tremendous seismic wave. The shock was

felt as far as Scotland and many cities suffered severely. In Morocco, more than 12,000 perished.

9 Baalbec, Syria, destroyed; 20,000 dead.

7 All the country from Santa Fe to Panama shaken; 40,000 dead.

2 At Caracas, 12,000 lives lost.

2 Aleppo destroyed; 20,000 killed.

2 At Cape Haytien, Santo Domingo, two-thirds of the town destroyed and 5,000 killed.

7 Over 10,000 killed in Calabria.

8 Many towns in Persia and Ecuador wiped out; 25,000 perished.

1 Japan suffered greatly; 10,000 dead.

'6 Northwest of Japan, 1,000 perished by earthquake and over 20,000 by attendant seismic wave.

'5 Several towns in Calabria district, 500 killed and thousands homeless.

'6 Formosa, 2,000 killed; $45,000,000 damages.

'6 San Francisco destroyed by shock and fire; 500 killed—200,000 homeless; $1,000,000,000 damages.

'6 Valparaiso, South America, destroyed by shock and fire; 5,000 killed; 100,000 homeless; $250,000,000 damages.

'7 January 14—Kingston, Jamaica, destroyed by shock and fire; 1,000 killed; 10,000 homeless; $25,000,000 damages.

It must not be inferred from the above statistics that these the only earthquakes that have occurred in the past ages. ey are only the principal ones within the historic period. om the appearance of the rocks in many parts of the earth eems that even greater convulsions have occurred in the past n any given in the above statistics. Be that as it may, statistics show terrible destructiveness of earthquakes; and y become more interesting and feared every year, from the t the population of the globe is becoming so great, and so ny great cities have sprung up all over the earth, that it is rly impossible for a great earthquake to occur without caus- the death of thousands and the loss of millions of dollars rth of property. We cannot tell what is in store for our at American cities. San Francisco has been stricken down. o can tell what city comes next? It may be New York, icago, Boston, St. Louis, Baltimore, Mobile, New Orleans or

4

any of the smaller towns; for no part of the earth is more exempt from earthquakes than from the law of gravitation which produces them.

CHAPTER IX.

VOLCANOES.

As we said at the outset, it is impossible to treat one of these subjects properly without including the other, at the same time; because they are so closely related to each other that a correct understanding of one presupposes a correct understanding of the other. However, if there is any possible

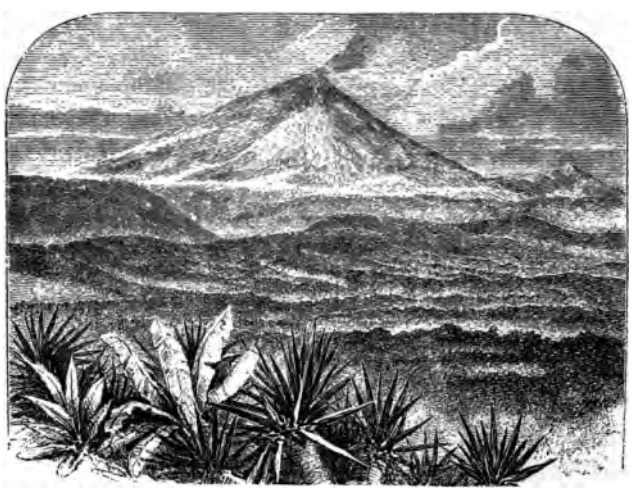

FIG. 13—Cotopaxi, South America. The highest volcano in the world.

difference between the causes that produce earthquakes and volcanoes, it is purely mechanical in some possible "downfall" of earth creating a jar in the earth's crust similar to an earthquake, but does not deserve to be classed as an earthquake proper. What we generally understand as an earthquake proper, is the seismic disturbance which originates deep down in the earth—which scares the rats and moles and snakes out of their hiding places and causes the owls to hoot and the fish to shoal. This is what we understand also regarding

volcanoes. But we will now direct our attention to volcanoes particularly, and earthquakes incidentally. In the discussion of earthquakes, in the first division of this book, we brought in the volcano Vesuvius, because we consider it closely allied to the earthquake that destroyed San Francisco, and Valparaiso. Vesuvius was in violent eruption on the 7th and 8th of April, and just ten days afterward, on the 18th of April, San Francisco was visited by the worst earthquake in its history, shaking it entirely from its foundation, by upheavals, side-movements and twisting contortions, that no earthly downfall could produce; and besides, following closely on its trail, Socorro, New Mexico, was violently shaken; and still traveling southward, Ecuador and Valparaiso were given a terrible shake-up. If they were not closely related, why not?

What is a volcano? There have been various definitions given from the remotest antiquity. Some approximately correct, and others very absurd. A volcano has been defined all the way from a "burning mountain" to "the infernal regions"; and some have thought it hell itself. But none of these definitions are correct. It is neither a "burning mountain," nor hades, although it may resemble both. A volcano is not necessarily a mountain at all. The mud and steam and gas and hot water that spouts forth from the earth in thousands of places are as much volcanoes as Stromboli or Vesuvius in eruption. The term originated from the ancients who were acquainted with only four or five in the Mediterranean area—"volcano" or "vulcano" being the name of one of these, in the Lipari Islands; and hence all similar phenomena assumed the same name. It is only in comparatively modern times that it became known that many volcanoes exist upon the globe. Vulcanus, Vulcano or Vulcan means the "god of fire." The ancients in their mythologies, being very ignorant, had a god for everything. The applications to which they alleged their superior power is too ignorant and simple to be given space in a book of this character. Hence, a volcano is simply any opening in the earth's crust from which issues fire, smoke, steam, gas, hot water, lava, ashes, cinders, pumice-stone, &c. The mountain part of every volcano has been formed by eruptions piled around the openings or craters. The eminent geologist, Mr. Poulett Scrope, and after him Prof. J. W. Judd, has thrown

much light on the subject; and possibly did all that could have been done under the circumstances. Living under the false assumption of the Nebular Hypothesis, which neither accounts for the comets, nor why planets revolve in ellipses, nor why the axes of the planets including the sun are not set at right angles to the plane of their orbits, nor why the whole solar system began to revolve from West to East instead of from East to West, it was perfectly natural to arrive at erroneous conclusions; but taking all in all, they were very correct in many of their conclusions, and slipped far enough away from old beaten paths to suggest the true theory of earthquakes and volcanoes by pointing out many incidents and coincidents which go to establish beyond question the close relation our earth bears to the other heavenly bodies including the sun and that earthquakes and volcanoes are undoubtedly influenced by these orbs in some unknown way to them. Had they applied the law of gravitation in all its bearings the problem would have been solved. Take, for instance, the atmospheric pressure which, at the level of the sea, is 15 pounds to the square inch; it is nothing more than gravitation drawing the particles of the air toward the earth in proportion to the matter in the air as the square of the distance. The great pioneer in this important branch of research was the Italian naturalist, Spallanzani, who in 1788 visited several volcanoes in Italy and published an account of the numerous and original observations made by him; but the first attempt to form a satisfactory theory of volcanic action, and to show the important part which volcanoes have played in the past history of our globe, was made in 1825, by Mr. Poulett Scrope; and his work may be regarded as the first systematic treatise on vulcanology. Since that time many new lines of inquiry have presented themselves and much new light has been thrown on the subject by recent researches and inventions that were never dreamed of by Prof. Poulett Scrope; but his researches set the science of vulcanology along at least 50 years. Pliny the elder lost his life in attempting to approach Vesuvius when it was in violent eruption. A volcano may be regarded as a vast natural steam engine and the earth is the boiler in which the steam is generated, and gravitation supplies the fire by pressure, and the oceans and subterranean rivers and creeks supply the water. So, there you

have all the parts laid out before you to examine as much as you please. Neither of these parts will make a volcano without the other. Neither will make an earthquake without the other. Spallanzani is the first to perceive the important fact that the nature of volcanic action remains the same, however its intensity may vary. Stromboli, in the Mediterranean Sea, affords the best opportunity of any volcano in the world to study volcanic activity with the least danger of being harmed. It is ever active, but never violent. It has been very constant and regular for at least 2,000 years; but its near neighbor, Vesuvius, is quite the opposite; and the activities going on in one is just the same as in the other, only differing in intensity. The molten matter within is in a boiling condition and does not

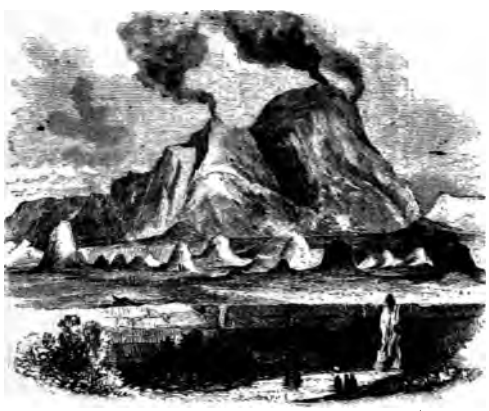

FIG. 14—Jorullo, Mexico.

resemble combustion in the least, but is heaving up and down, and when a large bubble bursts on the top the molten matter pours out over the top of the crater or through the cracked sides and overwhelms everything before it. Vesuvius rises to the height of nearly 4,000 feet above the sea level and an inspection of the photograph proves that the vapors and rock-fragments were thrown 4 miles into the atmosphere. You may form some idea of the power behind it by observing the facts. In one of these great eruptions such great quantities of steam rushed out with such awful noises that the inhabitants of Naples, five miles away, fled from their homes and spent the

night in the open streets. The earthquakes that accompanied these eruptions in 1872 were horrible in the extreme. Another striking phenomenon which accompanied the great eruption of Vesuvius in 1872 was the vivid display of lightning accompanied by thunder. Great columns of vapor and smoke rise to great heights, and, when the wind is not blowing, stands in a gigantic column over the mountain, and around this column of vapor and smoke the most vivid lightning plays and adds much to the awful character of the spectacle. It is a well known fact that when high-pressure steam is allowed to escape through an orifice, electricity is abundantly generated by friction. Every volcano in violent action is a very efficient hydro-electric machine, and the up-rushing column is in a condition of intense electrical excitation. The restoration of the condition of electrical stability between this column and the surrounding atmosphere is attended with the production of frequent lightning-flashes and thunder claps. The discharge of such large quantities of steam into the atmosphere soon causes the latter to be filled with watery vapor and an excessive rainfall follows. Long continued rain and floods generally follow an excessive volcanic eruption. In Vesuvius and Stromboli alike, the active cause of all the phenomena exhibited is found to be the escape of steam from the midst of masses of incandescent liquified rock. The violence and destruction depend on the abundance of steam. The great fear and dread of earthquakes and volcanoes would be taken away from the people if their approach could be predicted with any degree of certainty; but as yet science has not advanced that far. That these operations, like all others going on upon the globe, are governed by great natural laws we cannot for a moment doubt.

Some scientists seem to think that further observations and discoveries may reach such a point of perfection that we may be able to predict to a certainty when an earthquake or volcano may appear. However, I think this to be very uncertain. Has science reached such a point that it can calculate to a certainty the minute or second that a steam engine will generate enough steam to explode? We think not; science has figured out how much pressure the boiler can withstand before it will explode; but not how long it will take to generate

enough to explode it. Of course, this would depend on many conditions, among which we may mention a few: It would depend upon how much water was being added, and how much and what kind of fuel used, and how much draught was applied to increase the heat. Just so with a volcano or earthquake. The fuel is in the earth, the water is there, the heat is being applied all the time by pressure from gravitation; but when, oh! when will the boiler exxplode? Concerning the eruptions that have taken place, both in volcanoes and earthquakes, which have been known from remote antiquity, we have records which show the intervals between each occurrence and showing also the relative violence of each. A careful examination of these records leads to the following conclusions:

1. A long period between each eruption or quake is generally followed by severe eruptions or quakes, or of long duration.

2. A very violent or long-continued eruption is generally followed by a long period of rest.

3. Weak and short eruptions usually succeed each other by brief periods of rest.

4. As a rule, the intense violence of an eruption or quake is inversely proportional to its duration.

It will be observed that the foregoing conclusions are in perfect harmony with the theory that volcanic activity is due to the accumulation of steam in the interior of the earth, and that the tension of this imprisoned gas eventually overcomes the repressing forces that hold it down, and comes forth in terrible earthquakes and volcanoes that shake the outer crust of the entire earth. These repressing forces that hold it down are the immense amount of molten matter and the closely confined chambers through which it has to make its way and also the law of gravitation which continually presses the particles downward with an incessant hand and never failing power. As we have said before, the ultimate cause of all earthquakes and volcanoes is the accumulation of heat in the interior of the earth; and when we establish beyond question the power that produces this heat we have virtually solved the problem. All the other phenomena are only "accessories to the fact," and come in incidentally as a natural consequence.

The law of expansion will solve all earthquakes and vol-

canoes, after the heat and water are applied Then the question resolves itself into this: **Fire and water.** The water being already here as a constituent element in the earth, the remaining part to be answered is: what causes the fire? **Gravitation** is the answer. It is a question yet with some scientists whether the weather conditions have anything to do with the outburst of earthquakes and volcanoes. They have something to do with these phenomena only indirectly. The weather is as much the creature of the influence of the sun and moon and other planets as the earthquake and volcano. Of course, if this influence raises the atmospheric pressure to a certain extent, the acceleration of earthquakes and volcanoes is just aided that much. And if the sun discharges his currents of electricity and magnetism into our atmosphere, it is perfectly consistent to see that a sympathetic impulse would be set up in the approach of earthquakes and volcanoes. It is not the weather that exerts the influence over earthquakes and volcanoes, but it is the same force which causes the weather. We are so liable to take the effect for the cause. There was a time when astronomy was in the dark; when the earth was considered the center of the universe, and the sun and all the other heavenly bodies were considered as revolving around it. In fact, the earth was considered the biggest thing in all God's creation. The sun was considered to be about the size of a washing-tub, flying around the earth every 24 hours; in fact, everything was little compared to the earth. Now, exactly the reverse is taught; the earth is considered to be the least in God's creation, and instead of the sun flying around the earth, it turns out that the earth is flying around the sun, at the enormous rate of 19 miles a second, 1,140 miles a minute, or 68,400 miles an hour, making its circuit around the sun, 600,000,000 miles, in a year. Now, what I wish to show, is that if the true science of earthquakes and volcanoes had been advanced, back when astronomy was in the dark, the man would have probably been arrested as a dangerous lunatic or might have been beheaded. Even in the 14th century, when Columbus was trying to teach the people that the earth was round he was considered a crazy crank, and told that if the earth was to turn over all the water would pour out of the wells. Columbus at that time knew nothing of this great law of gravitation which binds the heav-

ens and the earth together, and causes not only the sun and all the heavenly bodies to revolve in their orbits, and to rotate on their axes, but also causes the sun to melt from pressure and give off light and heat in all directions; and also by its unceasing energy influences earthquakes in the earth and volcanoes in the moon. While Spallanzani and Dolomieu have given much time and talent to the investigation of the nature of the volcanic action going on at Stromboli, and the nature of volcanic rocks in the Lipari Islands, it is very doubtful whether they added very much information to the **true cause** of earthquakes and volcanoes, because they were laboring under a false impression in regard to the creation of our globe. The Bible says, "God created the heavens and the earth;" but the Nebular Hypothesis says that the "star dust" formed itself into worlds. Which shall we believe? For my part, I shall believe the Bible. And in doing so, I am able to assign all terrestrial and celestial phenomena to their true cause—laws which God created at the beginning from all eternity, to govern all His created things. And the great universal law of gravitation is the eternal power behind the throne that actuates and moves the universe. To teach otherwise, in the light of the twentieth century, would be nothing less than infidelity, and land us finally on the breakers of "exploded theories," and in the land of half-forgotten dreams. As all rock material in the earth, whether it be of marble or sandstone, whether it be of iron or platinum, is subject to fusion, it matters but very little to us whether we understand the nature of the composition of the rocks or not, in arriving at the true theory of earthquakes and volcanoes. As they all come under one general law, they will melt if sufficient heat is applied. So, any or all of them together will cause an earthquake or volcano, if sufficient heat is applied to melt them and water is added to make the steam. This brings us back to the main question: what causes the heat? **Gravitation.** So far as the chemical study of the different kinds of lava is concerned, we care nothing; because they exhibit nothing more than the sun, or moon, or any other of the planets would show when erupted by a volcano. For has not the sun been shown to contain the same elements as the earth and moon? There are about 60 elements so far discovered, and but 17 go to make up the crust of the earth; then

are we to be surprised that we have not found all the elements in the sun by spectrum analysis, which as yet is not a perfect science of itself? Surely we are gagging at a gnat and swallowing a camel, if we let such little things sidetrack us from the main line of God's eternal and universal law—**gravitation.**

We can cut up a beef and give names to all the parts—hide, hair, bones and blood; but this tells us nothing in regard to the power that caused the growth or development; so with a volcano. We can give technical names to all the rocks and lava, and yet know absolutely nothing concerning the cause back of all this, which produced this scoria. This seems to be self-evident to any rational mind that has not been hopelessly warped by previous fallacious convictions. If you are not convinced by such evidence and reasoning as the foregoing, we will drop you right here, as a hopeless imbecile. If we were testing the contents of a demijohn it might be appropriate to know something of the constituent elements inside; but what do we care about the liquid in the rocks when any or all of them will make gas or steam when heat is applied? From whence comes the heat, is the question. Nothing is more certain than the fact that the appearance of the Vesuvius of today is entirely different from the one on which the ancient Romans and Greeks were accustomed to look. The cone of today has been built up within the last 1,800 years, and, what is more, has been torn down and reconstructed many times during this period. The Vesuvius known to the ancients had a great cone whose diameter at the base was 8 or 9 miles, and whose height was about 4,000 feet. The 7 hills on which Rome was built were formed by volcanic power reaching back into the dim past, where not even tradition ventures to place its foot. But the indisputable evidence is there as exhibited in the rocks. The changes in the shape of Vesuvius, which are proved by documentary evidence, have been going on during the last 2,000 years. And as in the case of Vesuvius, it is true with all other active volcanoes throughout the world. Periods of activity alternate with periods of rest. In some instances these periods are prolonged hundreds and even thousands of years. All active volcanic mountains are continually growing in size, every eruption adding to the size of the cone, except in cases where the material is light enough to be blown away by the wind. The

quantity of rain which falls during volcanic eruptions is often enormous. This is caused by the overcharge and condensation of steam emitted from the vent. Consequently, the falling lapilli and dust do not reach the mountain in a dry state, but in the condition of a muddy paste. All lava streams are not hot alike; some are very hot and thin, moving along at a rapid rate, while others move very slowly along like a glacier, and it takes close observation to detect its motion at all. This demonstrates, conclusively, that some lava comes from very great depths in the earth, while others are forced up so slowly or come from much less depths that they are somewhat cooled before they reach the surface. Lava streams sometimes flow from 50 to 100 miles and have a depth of 500 feet.

CHAPTER X.

CYCLES OF VOLCANIC PHENOMENA—VOLCANIC FISSURES.

That when a volcanic vent is once formed, it may display intense activity through enormous periods of time, there cannot be the least reason for doubt. The accumulation of material around some volcanic vents must certainly have been going on for thousands and perhaps millions of years. To us whose opportunities of observation are so short, it may at first appear to be a hopeless task to trace the "life history of a volcano." But when we remember that we have the opportunity of studying and comparing hundreds of such volcanoes, exhibiting every phase of development, from the time when the first earthquake occurs, sometimes twenty years before the volcano appears, the task becomes quite easy. There is not the least room for doubt that during the past ages of the earth exhibitions of subterranean energy have occurred at many different parts of its surface. It is further very evident that all apparently extinct volcanoes, and those now in receding action, the succession of the outbursts has run through regular cycles, gradually increasing in intensity and as gradually dying away. But what else could we expect, if fire and water are the agencies in the hands of gravitation? Has not this heat been accumulating for hundreds and perhaps thousands of years? At the very critical point where the expansive force from below

overcomes the pressure from gravitation, the explosion or eruption occurs. That some of the milder manifestations now going on in some volcanoes, hot springs and geysers, and mud-volcanoes, will finally burst forth in terrible and destructive eruptions, there cannot be the least room for doubt. It only depends upon how long a sufficient amount of heat can escape through these vents to prevent an explosion; for heat is continually accumulating in the interior of the earth. These vents through which the eruptions take place are in the form of fissures or cracks; and if any cone of a volcano appears to contradict this fact, it is because, through long periods of eruptions these fissures have been filled up by matter exuded from below. Hence, all volcanic vents assume a linear course around the earth, generally from North to South, except a few inland volcanoes which we shall notice later. In many mining regions we have sufficient proof that many of the cracks made in the rocks by the upheaving force of imprisoned vapor never reach the surface. Now, if we give this our attention, a little nearer the surface we can see with our eyes what causes earthquakes in the earth. It is the repression of the expansive force from below, not being able to push its way to the surface in an eruption. The close connection between earthquakes and volcanoes does not admit of the smallest doubt; and all earthquakes which are not purely mechanical may be classed as an "incompleted effort to establish a volcano." That volcanoes are built along lines of fissures in the earth's crust, we have the most convincing proof. This molten mass from the interior, by coming in contact with water, generates steam, and if the heaving force from below is not sufficient to overcome the tremendous pressure from above, the energy dies away in many trembling earthquakes; but if the power from below is sufficient, it bursts forth in a thundering volcano. Not only have these fissures been seen forming at Vesuvius and Etna, but dissected volcanoes by denudation furnish the most convincing evidence of the same fact. Some people imagine that volcanic vents come up from below in an almost vertical line. In some instances for some distances this may be true; but the great number of vents in the earth's surface exude their way through the overlying rocks in many directions. They spread out in all directions, and some traverse between horizontal

strata, many hundreds of miles; and to these side veins or sheets, can be assigned the principal cause of earthquakes.

DISTRIBUTION OF VOLCANOES ON THE EARTH.

The present number of active volcanoes on the globe today is estimated to be 407. This does not include geysers, hot springs, gas jets and mud-volcanoes, whose number runs into the thousands. We will treat them separately in another chapter. As a rule, volcanoes are generally put in these classes: active, dormant and extinct. From the fact that tradition and history both point unmistakably to volcanoes which have slept for hundreds, thousands, or even more years and then burst forth again with renewed vigor and energy, we are not fully warranted in calling any volcano extinct. We shall see presently that they are continually changing their positions on the earth's surface from cycle to cycle, and in doing so, require thousands and even millions of years. In fact, there seems to be conclusive evidence in the rock forming the outside surface of the earth, that no part of the earth has entirely escaped the terrible force of volcanic activity. We find this evidence in the mountains and in the hillsides, in the valleys and in the plains. We find it everywhere and on all sides. We find on close examination that volcanoes, as a rule, are almost invariably situated close to the coast of the continents or at no great distance from them. There are indeed only six exceptions to this rule. It is a remarkable fact that all oceanic islands which are not coral-reefs, are composed of volcanic rocks; and many of these islands, as well as others lying near the shores of the continents, contain active volcanoes. Through the middle of the Atlantic Ocean runs a ridge, which has been explored in recent years and has been shown to divide the ocean lengthwise from North to South, into two basins.

Along this great ridge and the spurs extending from it, rise numerous mountain masses, which make the well known Atlantic Islands. All these are of volcanic origin, and among them are many active volcanoes. Iceland, situated along this ridge, contains 13 active volcanoes, and probably more. The Azores have 6 and the Canaries 3, while 8 lie off the coast of Africa. In the West Indies there are 6 active volcanoes, and

3 submarine volcanoes have been recorded in the Atlantic Ocean. No less than 40 active volcanoes are situated upon this great submarine ridge which divides the Atlantic from North to South. A far greater number of cones showing where ancient volcanoes existed are found. The probability is that these active volcanoes have taken the places of the old ones which became clogged with molten rock in the past and could no longer force their way out, but made new vents and new volcanoes. And many of them may have transferred their energy to some other vent or to some other part of the earth. This transfer of volcanic energy is going on all the time in the interior of the earth. In the group of islands separating the Pacific and Indian Oceans there exists many very active volcanoes. In Kamtchatka there are no less than 12 active volcanoes. In the Aleutian Islands 31. The chain of the Kuriles contains at least 10. The Japan Islands, 25. The great group of islands lying to the southeast of Asia, is the greatest center of volcanic activity at the present time on the globe. New Guinea has 4. The third great belt of volcanoes starts in Behring Sea, in the neighborhood of our new island which pushed up last June, and stretches along the whole western coast of the American continent, comprising about 85 active volcanoes. By referring to any good map we shall see that the first striking feature in regard to volcanoes is their linear arrangement, and the next great fact which confronts us is that they are nearly all arranged along fissures or cracks in the earth's surface, which have been opened by great upheavals of subterranean energy in past ages. The greatest band along which intense volcanic activity is exerting itself at the present day, extends from the Arctic Circle at Behring Straits to the Antarctic Circle at South Victoria. This line, which includes more than half the active volcanoes of the globe, gives off numerous off-shoots on both sides, branching out in various directions. Another great line, containing about 100 active volcanoes, extends along the whole western side of the American continent. In this great band is Mt. St. Elias, whose towering cone penetrates the sky to the distance of 18,000 feet. From the southern part of California a continuous band stretches through Mexico and Guatemala. The South American line continues through Ecuador, Bolivia and Chili.

This line of the Andes contains many of the most wonderful volcanoes in the world. Near to and southeast of Quito the capital of Ecuador, are two of the grandest volcanoes in the world, Cotopaxi and Chimborazo. Cotopaxi is the highest volcano in the world, 19,000 feet. During its eruption in 1758 the flames rose to a height of 2,700 feet above the crater. In 1741-44 the noise of its eruption was heard 600 miles away; and the fires were carried to a height of 5,000 feet. This continued for three years. In 1768 the cinders from its mouth kept the sky dark at midday for a long period. Various eruptions have occurred since, and during one of them immense volumes of mud containing fish were ejected. Chimborazo is now dormant. The Andes contain many noted volcanoes. Just South of Mexico City the immense plain in which it stands is cut off by a chain of high mountains running East and West and at right angles to the coast range. This chain is noted for its many active volcanoes, among which may be mentioned Orizaba, Cittaloptl, the "Mountain of the Star," Popocatepetl, 17,884 feet high, Iztacihutl and Toluca. The grandest of all is Popocatepetl. Its crater is a vast basin, with deep and almost perpendicular sides lined with jet black and rose-colored rocks. Since the days of Cortez, it has been only moderately active. Orizaba has been in repose since 1560. Jorullo, 120 miles from the sea and 80 miles from any other volcano, is of recent origin. On the night of September 28, 1759, after a two months series of earthquakes, a tract of land 4 miles square rose to a height of 524 feet in the center. Out of its top and sides flames shot forth, and the earth rolled like a billow. Red-hot stones were thrown to a great height, and clouds and ashes obscured the sun. Chasms opened in the earth and swallowed springs and streams. Thousands of small cones arose around the central cone, each emitting steam with a loud hissing noise. The central cone and five other cones gradually rose higher and higher till an altitude of 1,600 feet was reached. The eruptions from these thousands of mouths continued for 5 months when their violent activities ceased, though many continue to emit steam. Mount Esk, in the island of Jan Mayen, in 70 degrees and 49 minutes North latitude, is the most northern volcano in the world; and Mount Erebus, in South Victoria Land, in 77 degrees and 32 minutes South latitude, is the most

southern. From what has been said above, it will be seen that volcanoes not only assume a linear arrangement, but nearly all of them are thrown up along three well-marked bands, and the branches extending from them.

The first and most important of these bands is nearly 10,000 miles long; the second, 8,000; and the third 1,000 miles long, and contains about 300 active volcanoes. Thus we see that the

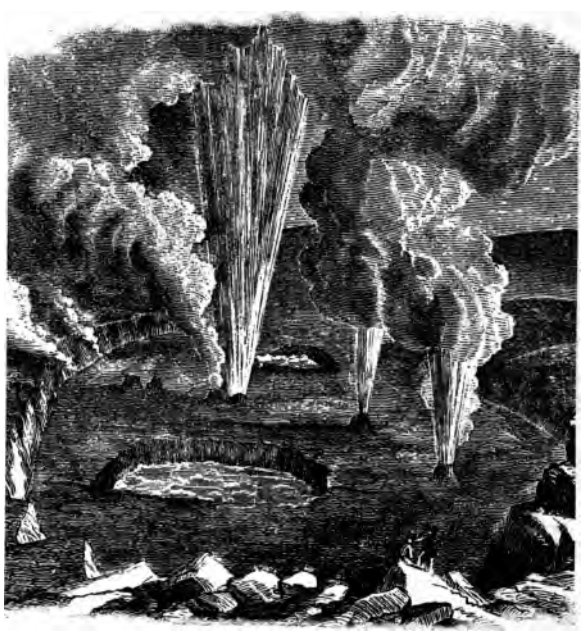

FIG. 15—Kilauea, Hawaii.

surface of the globe is covered by a network of volcanic bands, all of which traverse the globe in a North and South direction, giving off branches which run for hundreds of miles, and appear to form connection between the great bands. We must notice here two very prominent exceptions to the linear arrangement of volcanoes on the globe. In the center of the continent formed by Europe and Asia rise the remarkable volcanoes of the Thian Shan range. Three volcanic vents exist in this region. The second is the Sandwich Islands. While the

Thian Shan volcanoes rise from the largest unbroken land mass in the world, and stand on the edge of the loftiest and grandest plateau, the volcanoes of the Sandwich Islands rise from the center of the largest ocean and from the greatest depths in that ocean. All around the Sandwich Islands, which we usually call Hawaii, the ocean is from 2,000 to 3,000 fathoms, and the volcanic cones extend to nearly 14,000 feet above the sea-level. The volcanoes of the Hawaiian Islands surpass in bulk and height any others on the globe. The close proximity of volcanoes to the sea has been pointed out by geographers frequently. While we have just been giving the volcanoes which show themselves on the dry land or at the top of volcanic islands in the sea, it is perfectly consistent and reasonable, and in fact has been demonstrated by deep-soundings, that the bottom of the ocean is dotted all over with volcanic vents similar to the land and islands. There is one important point to be taken into consideration in arriving at this conclusion, and that is this: these volcanic vents in deep seas will scarcely ever reach the surface of the ocean, or attain to any great height, from the fact that denuding forces are always present in the ocean and these cones would be carried away by the sea-waves and other causes. And we have the most positive proof that such forces are at work at the sea-bottom, from the numerous earthquakes that occur far out in the ocean. No later than October 5, 1906, the seismographs at London and Washington and other points recorded a very violent earthquake taking place somewhere in the earth; and the London dispatches stated that it must be fully as severe as the one which destroyed San Francisco on April 18th, and that it continued for two hours; but it was decided that its center was under the Indian Ocean and that no harm would result to the nearest cities. Now, the probability is that a very large crater was formed under the Indian Ocean, and that the eruption was enormous. Or it may be the beginning of the approach of a volcano in that territory, and no outward appearance may be seen for years. In deep sea-soundings, the deepest holes are found in volcanic districts; many of them no doubt are the craters of vast volcanoes. In regard to the rising and subsiding of the continents or any other part of the earth, it is settled beyond a reasonable doubt that volcanoes are always found on rising

areas and conspicuously absent on falling coasts. This only goes to prove more forcibly that the interior of the earth cannot be solid, as some geologists believe; but from the surface downward it passes through all stages of consistency—from the solid rock on the outside down through a waxy, putty, doughy state, until we approach the center when we meet with incandescent rock and mineral matter in a highly heated state, which is constantly in motion, seeking relief by expansion, and consequently certain parts of the outer earth would naturally rise and other parts fall in order to accommodate the surging forces far down in the interior. Nothing could be more natural under the law of gravitation.

PERIODICAL VOLCANIC ACTION.

It is within quite recent times that the important doctrine of geological continuity has been generally accepted, furnishing us with a complete and satisfactory explanation of the mode of origin of the features of the earth. The great forces constantly at work producing modification in those features operate so silently and slowly, but so surely, that without the closest attention their effects may be easily overlooked. While on the other hand there are so many phenomena upon our globe that seem to point to sudden and violent upheavals, very different from which appear to be at present at work, that the tendency to account for all the past changes by these violent actions is very strong; but in spite of this tendency, the real forces at work have forced their way to recognition; so much so that the potency of these forces now at work upon the earth's crust extending through vast periods of time, and producing the grandest changes, is now admitted almost universally. For a long time geologists failed to recognize the similarity between the recent material ejected from active volcanoes and those rocks which are seen everywhere upon the earth's surface. And worst of all was, that the whole discussion took a theological turn, and those who contended that the rocks generally were of volcanic origin were branded as the worst of heretics. They did not recognize that this was God's way of creating the earth. It is not always safe to infer that the great masses and many layers of rock require long periods of time to form; because, at Vesuvius there were formed

seven distinct layers of rock of different character of great thickness in three days time. But very little accurate knowledge is to be gained concerning earthquakes and volcanoes by studying the chemical composition of rocks; and we may as well leave that off altogether. The power that generates the heat in the earth operates equally upon all matter within the earth as the square of the distance, and will make molten matter of all when the pressure from gravitation is sufficient in any mass of matter as large as the earth or moon. Some material would fuse or melt at 9 miles below the surface of the earth while others would melt at a distance of 18 miles. Some at 1,000 miles, and others at a greater distance. We see this exemplified in volcanic bombs. A piece of granite and a piece of pumice may at first sight seem to be entirely different; but put it to the chemical test and they are identically the same. Granite may be upheaved from five or six miles in the earth and pumice may come from a depth of 4,000 miles. You see the chemical analysis teaches nothing concerning their volcanic origin; and a scientist is very silly who spends much time around this point, when trying to arrive at the true cause of earthquakes and volcanoes. If we go back to the very oldest known rocks of the globe, those which are found underlying the Cambrian strata, we find abundant evidence that volcanic action took place during their formation. Thus we find clear proofs that before the oldest period recorded in geology, volcanoes existed in the earth. In fact, this volcanic energy that we see today is the force by which the Creator has brought the earth out of chaos, and presented it to us in its present symmetrical form. How beautiful and symmetrical are the laws of gravitation when rightly understood and rightly applied. The same law by which the Creator made the worlds and suns controls them in their orbits and produces all the varied phenomena of the universe. All these facts point to one conclusion, and that is: during all past geological periods, materials similar to those which are now being erupted from volcanic vents were poured out on the earth's surface by agencies identical with those today. Indeed, it could not be otherwise. The great law of gravitation always acts upon matter in the same way, and hence produces the same results. From a careful survey of the volcanic rocks of different ages, we

are forced to the interesting and important conclusion that the fields of volcanic action have been continually shifting to fresh areas at different periods of the earth's history. We have abundant proof that the volcanic energy has made its appearance at a certain part of the earth's crust, has increased in intensity for a time, and then slowly declined; but as these manifestations have died away at one part of the earth, they have gradually shifted and made their appearance at another. In every district which has been examined, we find abundant proof that volcanic power has been developed at certain periods, and has disappeared during longer or shorter periods and then reappeared in the same area. And on the other hand, we find that there is no past geological period in which we have not abundant evidence that volcanic outbursts occurred on some portion of the earth's surface. Were we to examine any other part of the earth's surface we would arrive at the same conclusion. Hence, geologists have been forced to certain conclusions, the causes of which they could not understand, because the most of them have been laboring under the impression that the earth was once a molten mass of fire and during all the past ages has been cooling off. Of course, laboring under false impressions, and from false premises, they would naturally arrive at wrong conclusions. But they are led to the correct conclusion in stating positively that the subterranean forces are in a state of continued "flux" over the earth's surface; but none of them seem to know the reason why. They also state that the energy is constant, that it does not increase nor diminish, but is continually shifting on the earth's surface. Had they been making these statements with a full understanding that the laws of gravitation caused all these phenomena, they could not have made a stronger statement in substantiation of the theory of gravitation. This theory presupposes that heat will collect gradually and increase gradually as long as the earth can endure it; but when the critical point is reached an explosion occurs and the disturbance is kept up by earthquakes and eruptions till that territory is relieved of its tremendous pressure, and then the eruption gradually dies away as the heat and steam and gases escape through the crater. Now, in the occurrence of volcanic activity shifting from place to place on the surface of the globe, it is explainable

on the grounds that these cracks or vents become loaded down, and choked up by the vast amount of matter accumulating, and find an easier way of escape in another area.

VOLCANOES IN THE ECONOMY OF NATURE.

The very first impression produced upon the mind when the phenomena of earthquakes and volcanoes are presented, is that they are exhibitions of the most destructive violence whose effects must be entirely mischievous and disastrous to the living beings occupying the earth; but a little consideration will convince us that the grand and terrible character of earthquake and volcanic activity has caused us to form exaggerated notions concerning their destructiveness. The fact that districts situated over the most dangerous earthquake and volcanic disturbance, such as Java and Japan, are very productive and thickly settled, should cause us to pause before we condemn volcanic action as only productive of mischief to the living beings on the earth. The actual slopes of Etna and Vesuvius, and most all the active volcanoes, are thickly grown with vineyards and forests and dotted all over with populous villages. As a matter of fact, the amount of damage to life and property caused by volcanic eruptions is small. Usually the people are warned of the approach of great volcanic eruptions, by earthquakes, sometimes for years in advance of their appearance, and are enabled to escape with their life and belongings to places of safety. Earthquakes, as we have seen in the destruction of San Francisco and Valparaiso, are much more terrible than volcanoes. They jump upon us without a moment's warning, and whole countries and cities are suddenly plunged into chaos, and famine and pestilence usually follow as a consequence. It may well be doubted whether the annual average of destruction to life and property caused by earthquakes and volcanoes equals that produced by floods and hurricanes. Yet we know that the circulation of water and air over the earth are beneficial and absolutely necessary, and the mischief which they occasionally do is quite insignificant to the good which they effect. In the same way we must understand that the subterranean energies are necessary and important to the continued existence of our globe as a habitation for man, and that the destructiveness and mischievous effects

of these energies are but very small and insignificant when compared to the beneficial results which they produce. Water by its denuding action upon land, and heat and cold by their disintegrating influence, cause the land to become productive solely for the benefit of mankind. The volcanic energies going on all the time in the earth causes upheavals of sand, lava and pumice-stone which in time becomes the most fertile soil and are washed down the mountain sides into the valleys below, making our richest plains and valleys. These are some of the great benefits derived from these forces which we usually consider only mischievous. There must of necessity be a compensating force going on all the time to equalize this tearing down and denuding process; or we would find our hills and mountains in a few thousand years in the bottom of the ocean. And this compensation is carried on in earthquakes and volcanoes. Volcanoes have been aptly termed the safety-valves of the globe, and when we come to consider them in their proper sphere, we shall see that the simile has not been overdrawn, for volcanoes are always found on rising territory and absent on falling. The first geologist who attempted to show the relations existing between the rising continents and volcanic eruptions was the late Mr. Poulett Scrope. At a later date Mr. Darwin added very much to this information. There is nothing that fits more nicely in all the working machinery of the universe than gravitation. The very movements of the sun, and the rising and falling of the continents, which are going on all the time on the earth, and the rise and fall of the tides every 24 hours, which are nothing but gravitation working between the earth and moon as the square of the distance, all work together with such harmony and regularity, the only wonder is that some one has not thought of this before. There may be some "anomalies" that may seem a little inconsistent to some scientists, but there is not a single ripple ever enters my mind to cause me to doubt in the least but that all true knowledge of the phenomena going on around us everywhere must be worked out on this line if ever a true solution is given. The sun, and all the planets including the earth, can be reduced to a gas; when thus reduced, it would come into its natural condition in space before the Creator moved upon it. The Creator must adopt some law by which He can control all His works. Gravitation, or this law of attraction, whatever it is, is the law the Creator adopted.

CHAPTER XI.

MUD VOLCANOES.

A region near the mouth of the Indus, about 800 square miles in extent, is thickly studded with mud-volcanoes. One of the cones is about 400 feet high, and is built up of light colored earth. Its crater at the top is 90 feet in diameter and is filled with liquid mud. The mud-volcanoes of Thurback, as described by Humboldt, consist of about 20 cones, varying in height from 19 to 25 feet; and their craters are filled with water and soft clay. About three times a minute bubbles of gas burst up through the liquid mass with considerable noise and with sufficient force to cause the water to flow over the rim. The mud-volcanoes of Aquachapa, in Central America, are known to have been in action for the past 300 years. A dense white steam rises from a semi-fluid mass of mud and water which boils furiously, and the ground all around for a considerable distance is too hot to tread upon. In Sicily, Java, Trinidad and Central Asia, mud-volcanoes are also found. The district of Bakon, situated West of the Caspian Sea, not only abounds in mud-volcanoes but also contains a large depressed region called the Field of Fire. The soil here is filled with naphtha, and the surface is full of cracks, some emitting flames and others smoke and inflammable gases. This locality was the famous shrine of the Fire Worshipers of Persia. Fire springs are now found in China. They are fountains of water mingled with streams of inflammable gas, which rise from the earth, either through artificial borings or natural vents. In China, shafts have been sunk from 1,500 to 3,000 feet, for the purpose of procuring salt water. From some of these holes inflammable gas issues in such volumes that when fire is applied a blue flame rises to the height of 30 or 40 feet with great force and noise, and is used for evaporating the salt water. Some time ago borings were made for brine near the Great Kanawha River in West Virginia, and when the salt water was reached a large and constant stream of inflammable gas issued with great force and violence. It made a flame several feet wide

and 150 feet long, which was used for evaporating the brine. This gas lasted for more than a year. We give the instances above in order to show that not only melted rock and lava issue from various orifices all over the earth, but that the earth is relieved of vast quantities of accumulated heat within, through mud-volcanoes and fire-springs. This, it seems, ought to be positive proof that the earth is continually generating heat within and is not dying out and cooling off as some scientists would have us believe. These hot mud-volcanoes have been in activity for a fact, for 300 years, or during all the time since discovered. Now, if they are not declining any in the least, and have been in operation for 300 years and perhaps for 3,000,000 years, when will this decline set in? If no decline is appreciable, how do we know there is any? Had we not better assign these causes to their proper places in the earth's economy in relieving itself of surplus accumulated heat caused by pressure from gravitation, and not have quite so many "perhaps"? It seems that this is the more rational way. If the earth is cooling off in a way not appreciable, how do we know it is cooling off at all? This cooling off process necessarily follows the Nebular Hypothesis. And from the fact that the Nebular Hypothesis is wrong, or the Bible is a lie, it necessarily follows that this cooling off process is wrong also. Whenever we come to recognize the fact that God knows better how He made the heavens and the earth than Kant or Laplace, the Nebular Hypothesis will be abandoned and we will be getting back to the solid rock-foundation of faith and common sense, and away from the moth-eaten and rotten foundation of infidelity. The fact is, this solar system is too big a thing for most men to handle, anyway. They would like to handle it in a small way, but it will not work. Men tried for hundreds of years to make the sun and all the planets revolve in circles; but they would not do it by 8 minutes of a degree; and on these 8 minutes Kepler constructed the true theory of our solar system. They thought surely God would not take a flattened circle around which the planets must revolve, but He did. So, you see men in high places are not so wise as they sometimes seem to be. Sometimes the closer you get to them the less they appear. The earth is virtually cooling off all the time, but not in the sense that some would have us understand. It

is constantly throwing off all the surplus heat generated far down in the interior, through volcanoes, earthquakes, mud-volcanoes, hot springs, gas vents, and so on, or it would come to an end almost instantaneously; but the Creator has prepared a way by which it can go on indefinitely, should He so design; but He has the law by which He can bring it to a sudden standstill at any time He may choose to do so. It has been shown that volcanoes are everywhere upon the face of the earth; but the most remarkable volcanic region on the face of the globe is Java. It is only about as large as the State of New York, but has, according to the latest researches, no less than 46 volcanoes, of which 20 are active, whose eruptions are of the most violent character.

FOLLOWING ARE THE DISTRIBUTION OF VOLCANOES ON THE EARTH:

LINEAR VOLCANOES.

Santorini	1
Thian-Shan	2
Red Sea	2
Friendly Islands	2
Australian Islands	13
Suda Islands	80
Molucca, Formosa and Philippines	37
Kurile Islands	18
Japan	23
Ladrone Islands	7
Kamtchatka	21
Boscin-Sima Islands	2
Aleutian Islands	35
Northwestern America	10
Mexico	7
Central America	38
West Indies	10
Ecuador	17
Bolivia and Peru	12
Chile	22
Terra del Fuego and South Shetland Islands	4
South Victoria Land	2
Total	365

CENTRAL VOLCANOES.

Etna	1
Vesuvius	1
Lipari Islands	2
Jan Mayen	2
Iceland	8
Azores	2
Canary Islands	7
Cape Verd	1
Ascension	1
Tristan Acunha	1
Traverse Islands	1
Trinidad	1
Bourbon	3
Hawaii	4
Galapagos Islands	1
Marquisas Islands	1
Society Islands	1
Easter Islands	1
Western Asia	3
Total	42
Total linear	365
Grand total	407

CHAPTER XII.

HOT SPRINGS.

There are many kinds of springs gushing forth from the earth at all times. We have constant, variable, periodical, mineral, petroleum and thermal or hot springs. But by far the most peculiar and interesting are hot springs. They gush forth at various places on the earth and excite curiosity from everyone, because of their peculiar nature. That they come from very great depths in the earth cannot for a moment be doubted. An artesian well may be classed with this kind. At St. Louis, Mo., there is an artesian well 400 feet deeper than the famous well at Grenelle in Paris; this famous well in Paris discharges 500,000 gallons of water every 24 hours. By means of artesian wells deserts are made to blossom as the rose. In the great Sahara desert there is a well of this character gushing forth 1,000 gallons of water per minute. The natives call it the "Fountain of Peace."

Near Little Rock, Arkansas, in the United States, is a group of hot springs numbering 80 in all, which burst out from the side and base of a mountain forming a stream sufficient to turn a mill. The temperature of these springs is 150 degrees Fah. Within 10 feet of one of these hot springs is a cold spring having a temperature of 50 degrees. A cool draught can be taken from one and a cooked egg from the other. This has been frequently done. The proximity of hot springs to cold ones is not uncommon. A remarkable instance of this kind is found in the Fiji Islands. On landing you will see hot water steaming through the gravel which in some places was too hot to stand on. It came from 5 springs which filled a basin 40 feet in diameter, whose temperature ranged from 200 to 210 degrees Fah. Another stream flowed close by whose temperature was only 75 degrees. East of the Cascade Mountains, in latitude 40 degrees, 39 minutes and 46 seconds North, there is a basin several hundred feet in circumference filled with hot water. Within a circular space of 15 feet the water boiled up at irregular intervals with much violence. Its tem-

perature near the margin was 208 degrees Fah. Magnificent hot springs are also found in Australia. Lake Rotomahara is heated to the temperature of 104 degrees Fah. by the many hot springs that rise from its bottom and along its bank. Tavata, the finest of these springs, at the northeastern end of the lake, forms a basin 80 feet long and 60 feet broad, filled to the brim with clear, boiling water, which rises in the center in a massive column several feet higher than the center of the basin. In the neighborhood of this lake are 25 large and many small hot springs. But the most wonderful springs of this class are those of Iceland. They occur in many parts of the island, but are mostly found in a plain 36 miles from Mount Hecla. Here within an area of two miles are more than 100 springs, some of which boil incessantly without any flowing, but others shoot upwards in lofty jets. The most remarkable of these fountains are the Great Geyser and New Geyser. These geysers are nothing more nor less than water volcanoes. The Great Geyser is situated within a large circular mound or cone formed by the outwelling of the material carried up by the eruptions from the interior of the earth, the same as any other volcano. The basin is 50 feet in diameter and is filled to the depth of 4 feet with clear, crystal hot water, gently bubbling. In the center is an opening 80 feet deep and 10 feet in diameter which, widening out like a funnel at the top, forms the basin or crater. But the fountain is not long in repose, for the geyser is an intermittent hot spring; or, in other words, is an active water-volcano. Small jets 20 feet high frequently occur, but the principal eruptions take place in about a day. They are announced by loud explosions not unlike the discharge of a cannon. At once the water becomes greatly disturbed and boils furiously, when suddenly it is projected into the air in a succession of jets, increasing in volume and height until it rushes upwards in a great torrent, forming a great column and rolls away in great clouds of steam. The height of these jets depend, of course, upon the force behind. They range all the way from 90 to 360 feet. Hot springs are found in all parts of the world. They are found in the frozen North and in the sunny South. Streams of like character gush from the sides of the Himalaya Mountains and from the volcanic soil of Japan and from points in Siberia. The "hot-wells" at

Bristol, England, are known to have been constantly flowing for a period of 2,000 years.

YELLOWSTONE NATIONAL PARK.

The most wonderful region in the United States, if not in the world, is the **Yellowstone National Park.** The National Government has set aside this wonderful region as a park, and

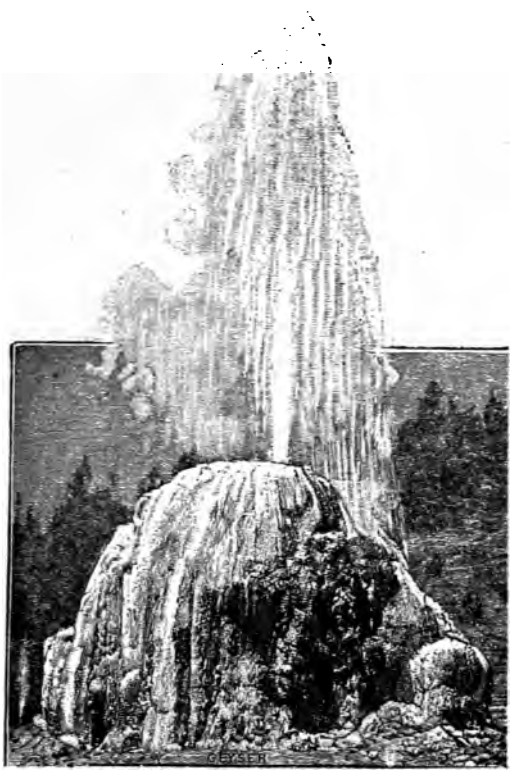

FIG. 16—Geyser, Yellowstone National Park.

hundreds of people travel there every year to behold its fascinating scenery. In this wonderful region the Yellowstone River plunges over a precipice 308 feet high in a single fall, which is nearly twice as high as the Niagara Falls in New York. In the deep gorges the river has cut below the falls, the rocky cliffs in places are fully 1,200 feet high, and beauti-

fully colored. The Colorado Canyon, an immense river valley cut in the rocks of the plateau in places over a mile deep, is another very interesting place to visit; but by far the most interesting place to behold is in the northwestern part of Wyoming, where thousands of hot springs abound, where the water is so hot that it boils. At some points boiling water and steam frequently shoot up with a great roaring noise to the height of 200 feet, and there are upwards of 3,000 of such hot springs and geysers in this region.

Now, after giving these circumstances concerning hot springs, it seems almost useless to place them alongside of other volcanoes and show that they are nothing but the manifestation of the same internal power that produces earthquakes and volcanoes that emit more substantial elements than water alone. The fact seems to be self-evident and demands no proof. But a few reflections on this point may not be amiss. These spurting jets of hot water pouring out at all points of the earth's surface, show conclusively that they come from great depths in the earth. And they show, furthermore, that the active volcanoes which are pouring forth lava and steam from every pore are not the only means by which the earth is relieved of its constantly accumulating heat from within by pressure from gravitation. There is not the least doubt but that all the hot springs from every clime, representing every degree of temperature, relieve the earth of many millions of tons more pressure from within caused by heat than all the other volcanoes on the surface of the globe. If we had any way by which we could arrive at the exact amount in tons that these thousands of hot springs relieve the earth of every year, we no doubt would be surprised to find them far in advance of all other agencies. Of course, the earth constantly accumulating heat within must be relieved; and I am sure these little insignificant hot springs that we scarcely notice spurting forth uninterruptedly and constantly, through millions of mouths, are discharging an important duty in the economy of creation by relieving the earth of its surplus heat generated by pressure through gravitation. Could we stand off and behold all these volcanoes and hot springs and steam jets constantly at work we certainly would come to the conclusion that the earth is a steam engine at work, and on a very large

scale. In comparison to the lava volcanoes, hot springs relieve the earth of much more heat in the run of a year than lava volcanoes. And no doubt hot springs and geysers are obeying the same law as other volcanoes and will shift about from place to place on the earth's surface and become extinct at one point and make their appearance at another. For it seems impossible that they could continue forever at one point when they are constantly bringing up sediment from below and filling up and choking up the vents through which they are now flowing. This cooling off or subsiding process that some think they have discovered is nothing more than a transfer of power from one place to another. And could observation be carried on all over the earth at the same time, we would no doubt find that when one geyser or hot spring apparently becomes extinct at one point on the earth's surface, that it reappears at another. This is what would occur under the ever attracting influence of gravitation. Because as gravitation is a constant force it will produce about the same amount of heat in the interior of the earth at all times. And the earth must be relieved; and if one vent is closed another will be opened. This seems to be self-evident. Having confined ourselves mainly to the earth alone in this treatise, so far, we will now proceed to show what relation the earth sustains to the balance of the solar system in regard to the production of earthquakes and volcanoes.

CHAPTER XIII.

THE SUN.

The sun's average distance from the earth is	91,500,000 miles
The sun approaches the earth in winter by	3,000,000 miles
Its diameter is about	850,000 miles
Its circumference is	2,550,000 miles
It is larger than the earth by	1,300,000 times
Its weight is about two octillion tons—	2,000,000,000,000,000,000,000,000,000

It rotates on its axis in about 25 of our days. The following include all the elements that are now known to exist in the sun: Sodium, calcium, barium, magnesium, iron, chromium, nickel, copper, zinc, strontium, cardium, cobalt, hydrogen, manganese, aluminum and titanium—16 in all.

THE EARTH.

The earth's diameter is about ..... 8,000 miles
Its circumference is about .....25,000 miles

Its weight is about 6 sextillion tons:—6,069,000,000,000,-000,000,000.

It rotates on its axis in about 24 hours.

It revolves around the sun in 365 days, 5 hours, 48 minutes, 49 seconds.

The length of its orbit around the sun is 600,000,000 miles.

It has the same constituent elements as given above in the sun and a few more.

The earth rotates at the rate of 1,000 miles per hour at the equator.

It travels through space around the sun at the rate of 68,000 miles per hour.

It rotates and revolves from West to East.

FIG. 17—Map of the Moon.

THE MOON.

The moon's diameter is about ..... 2,160 miles
Its circumference is about ..... 6,480 miles

Its weight is 78 quintillion tons—78,000,000,000,000,000,000.

It rotates on its axis in about 27 days.

It travels through space at the rate of 2,273 miles per hour.

It rotates and revolves from West to East.

It has the same constituent elements as the earth and sun.

Now, the other planets are exactly similar to those given above with the exception that their density may vary; but they are all controlled and regulated by the same law—gravitation. In the following pages we will treat the subject of earthquakes and volcanoes from an astronomical standpoint.

SUN SPOTS.

The following is taken from the Manchester Guardian:

"The great sun spot which was so conspicuous three weeks ago has again appeared in the course of the sun's rotation and will be visible for the next few days. It is not often that sun spots are large enough to be visible to the naked eye, and it was indeed, only Galileo's invention of the telescope that taught mankind that,

> 'The very source and power of day
> Is dashed with wandering isles of night.'

Such a gigantic spot as that now visible, certainly far larger than the whole earth, must have been noticed now and then by wandering observers; but its appearance was probably put down as a defect of human vision. Of course, the extreme splendor of the sun defeats any attempt to see even the largest spots on its surface by looking straight at his noonday radiance; but the present spot can be seen when his disc is regarded through a piece of smoked glass, or when the sun is veiled by a thin cloud, or is sinking through the haze that so often attends on sunset in manufacturing districts. A very good way to see it is to take a small telescope, one of those used by children as toys will do quite well, and to point it to the sun so that his image is allowed to fall upon a piece of white cardboard held in front of the eye-piece of the telescope. In this way several people at once can see the spots on the sun, which are of peculiar interest in view of the relations that have been established between their existence and the meteorological conditions of the earth. In the early days of astronomy all kinds of quaint guesses as to the nature of sun spots were put forward. Some held that they were but the shadows of small planets passing between the sun and the earth, but the telescope soon upset that theory. Others thought that they

were clouds in the solar atmosphere of heaps of slag and cinders vomited up by the blaze of his conflagration. One astronomer —theologian—even put forward a suggestion in all seriousness, that the sun was hell, and that the spots were assemblages of lost souls crowding together for mutual consolation. Even this was hardly a wilder theory than that of Sir William Herschel, that the spots were holes in the fiery atmosphere of the sun, through which the intelligent beings whom he supposed to inhabit the cool interior globe, could get occasional glimpses of

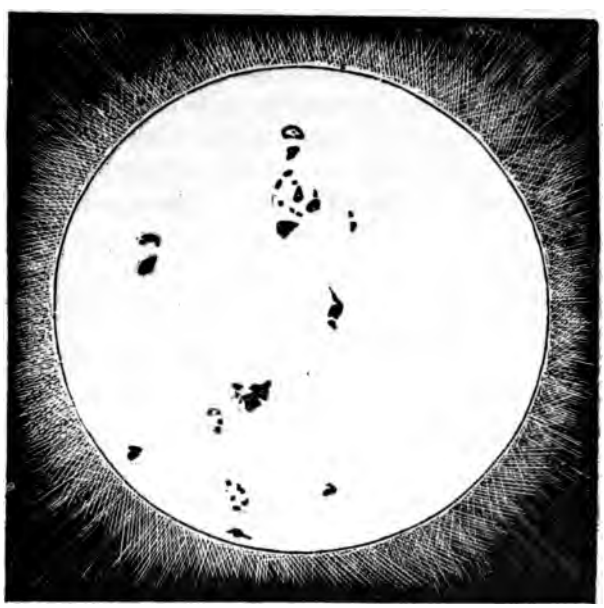

FIG. 18—Sun spots as they appear in the Telescope.

the outer universe. We know that the sun is the seat of an undying fire in comparison with which Dante's wildest dreams were frigid. The sun spots mark hollows in the fiery clouds of the solar atmosphere, which only look dark because they are protected against the radiant light of the general surface. They are certainly at a temperature far exceeding that of our hottest furnace. Probably the nearest approach to the truth about them is still Faye's supposition that they mark the center of solar cyclones somewhat analogous to those in our own atmosphere, only the whirlwind is composed of white-hot hydrogen

and metallic vapors traveling thousands of miles in a second, and sometimes as much as a hundred thousand miles in diameter. If the earth were dropped into one of these vortices it would vanish like a ball of wax in a blast furnace. The real problem of sun spots deals with their influence upon the earth. More than a century ago Sir William Herschel tried to show that the price of wheat in England was affected by the presence of a few or many spots on the sun. The relation is far from simple, but that there is some relation is almost certain. It has long been established that there is some direct correspondence between the appearance of spots on the sun and magnetic storms on the earth. Apparently the conditions which lead to the formation of sun spots coincide with the emission of some ethereal influence analogous to the waves of wireless telegraphy, which affects the electrical state of the earth's atmosphere. It is furthr known that changes in atmospheric electricity are largely concerned in that mystery which we know as weather. Many attempst have been made to synchronize the eleven-year cycle in which sun spots wax and wane with similar cyclones in terrestrial phenomena.

Sir Norman Lockyer, for instance, has conclusively proved the existence of a corresponding periodicity in the records of Indian famine. The sun is far more than the giver of heat and light to the earth. Probably there is no physical change in the planet which we inhabit but could be traced to some disturbance on the sun, though we are only just dimly beginning to perceive the ethereal mechanism by which these effects are produced."

Now, had I chosen the author of the above article and sat at his elbow and dictated to him the prelude to what I am going to say, I could not have dictated a better article; for he has undoubtedly the proper conception of the **effects** of our sun on the earth, without attempting to give the **cause.** Had he looked a little further into the sun, or had he perched himself on some pinnacle nearby, he could have seen a huge volcano in the sun with its huge crater spurting up lava to thousands of miles, exactly similar to Vesuvius or Stromboli. The sun being much larger than the whole solar system, it holds the planets in its grasp by the law of gravitation and drags them through space at the rate of many thousands of miles an

hour. Every time we have a great convulsion at Vesuvius and Stromboli, the great eruptive force of the explosion causes terrible electrical storms and cyclones in and around those volcanoes; and the lightnings and thunders that accompany these great eruptions are exactly similar to all other electrical storms that occur at all places on the earth. If Stromboli and Vesuvius can raise such storms, lightning and thunder, is it any wonder that a huge volcano in the sun can disturb the equilibrium of our atmosphere and cause great electrical storms, cyclones and floods? And what occurs at Stromboli and Vesuvius, occurs at the vent of every other active volcano on the earth. It seems that the close relation between sun spots or volcanoes in the sun, and the electrical disturbance set up in our atmosphere, has been observed, but no reason assigned. It is said, and truly, that the thunder and lightning around all active volcanoes in eruption, is caused by the escape of steam and great quantities of vapor liberated in the eruption. It has been proven that the escape of steam generates electricity very rapidly. The condensing vapor makes the rain. So, the sun being a member of our solar system and subject to the same laws and regulations as the earth and the other planets, including the moon, is it any wonder that "dark spots" or volcanoes in the sun, create tremendous disturbance in our atmosphere causing cyclones and electrical stoms? If they did not, they would not be obeying the same laws as Stromboli and Vesuvius. And this is not all. Even when the sun is not in eruption, its rays of intense heat are constantly pouring torrents of electricity into our atmosphere by friction through the air, causing electrical storms. The sun, moon and earth belong to a family of worlds and are moved by the same law and by the same impulses. Whatever affects the sun, affects the moon and earth and all the other planets. Under this powerful law of gravitation, this must be so. "We know that the sun is the seat of an undying fire." Whence its replenishment? From whence does it get its fuel to burn on forever? We might as truthfully say, we know that the sun is obeying some undying law. That law is **gravitation.** And the sun is not waning and burning out; if it was, it would lose some of its attractive force by losing some of its matter. We have positively no evidence that the sun is losing any of its power. It is contrary to God's de-

sign that it should. The sun acting under the power of gravitation generates every electrical storm in our atmosphere except those generated around vents of volcanoes, and a few by the mechanical processes of explosion, which are identical with those produced by the sun in eruption. So, all this talk about the sun burning out is silly babble emanating from persons who do not look very deep below the surface. It is said that if the heat of the sun were produced by the burning of coal, it would require a layer 10 feet in thickness, extending over the whole sun, to feed the flame a single hour. So, the sun evidently can not be a combustible mass. It must be a substance similar to the other members of the solar system, whose heat is generated by pressure from the law of gravitation. The linear arrangement of sun spots or volcanoes in the sun, is exactly the same as on the earth. Every convulsion of nature which is God at work, causes a corresponding disturbance in our atmosphere. Did we not have a terrible storm in the bay at San Francisco following closely on the heels of the earthquake on April 18th? Did we not have another similar storm in the bay at Valparaiso in Chili on August 16th that followed immediately after the destruction of that city by earthquake? What better proof do we want of the perfect consistency and truthfulness of this theory of gravitation? As witnesses to this fact, we point to every earthquake and every volcano that has occurred both in the earth and in the sun. We have noticed in another chapter, that volcanoes and earthquakes occur more frequently in winter than in summer, and more frequently in the night than daytime. Is it any wonder that they should when the sun is 3,000,000 miles closer the earth in winter than in summer; and his attractive force is increased by the square of the distance, which is nine trillion times—9,000,000,000,000; and his influence is transferred from one side of the earth to the other in the night time? The moon also exercises a little modifying effect on the time and manner of these disturbances, but she is so little that it does not amount to much. The moon only exercises what power she has in her mass, through gravitation in tides and winds. The sun spots or volcanoes in the sun do not influence the fruitfulness of the seasons any further than the destructive nature of storms and cyclones caused by these eruptions in the sun. So, sun spots do not influence the price of a bushel of

wheat except as above. Now, the sun is not losing any of its power. And it never will until Gabriel sets one foot upon the land and the other upon the sea, and declares that time shall be no more. As proof of this fact we can only refer you to the words of the Creator.

Rev. 6:12, 13, 14: (12) "And I beheld when he had opened the sixth seal, and lo, there was a great earthquake, and the sun became black as sackcloth of hair, and the moon became as blood. (13) And the stars of heaven fell unto the earth, even as a fig tree casteth her untimely figs when she is shaken of a mighty wind. (14) And the heaven departed as a scroll when it is rolled together; and every mountain and island were moved out of their places."

Joel 3:15.—"The sun and the moon shall be darkened, and the stars shall withdraw their shining."

Rev. 21:1.—"And I saw a new heaven and a new earth: for the first heaven and the first earth were passed away; and there was no more sea."

Some people are opposed to mixing science and religion; but the fact is, true science is already mixed with the scripture: if it is not, it is of the Devil. All scripture is given by inspiration of God; hence, every inspired word in the scripture is the word of God.

"Ye golden lamps of heaven farewell,
With all your lurid light;
Farewell thou ever changing moon,
Pale empress of the night.
And thou refulgent orb of day,
In brightest flames arrayed,
My soul which springs beyond thy sphere,
No more demands thy aid:
Ye stars are but the shining dust,
Of my divine abode,
The pavements of those heavenly courts,
Where I shall reign with God."

CHAPTER XIV.

WHEN WILL THE OLD EARTH DIE?

An Extract.

"When will the earth die—or will she ever die? This question is one that the astronomers are asking; but from what source will come their answer? Yet it is proven by nature that all things which have life must have been born, and all things which have been born must die sooner or later. The noted astronomer, Richard Procter, has made the life of our planet a deep study, and he declares it to be at least ten million years old. Astronomers there are who say the earth is five hundred million years old; others, that it is one hundred million; and from that all the way down to ten million; but from the numerous processes through which this planet has passed all astronomers agree that it has been in existence at least ten million years. And the astronomers also tell us that the earth has doubtless lived half her life—perhaps more. It is estimated that if the present "drying-up" process of the water on the earth's surface is continued—and there is reason to believe that it will rapidly increase rather than diminish, the life of the earth is doomed, so far as any animal or plant existence on it is concerned. As the crust keeps cooling, the body will become more porous, drinking in the waters of rivers, lakes, seas, and oceans. At the present rate of water diminishment on the earth she will be a dry and lifeless ball at the expiration of fifteen million years. But even before the last water is dried up —millions of years before, human and animal life will have become extinct, for as the water disappears and the earth cools, the nitrogen and oxygen of the atmosphere will diminish. Indeed, it is diminishing all the time, but so gradual that thousands and thousands of years will pass before the air becomes noticeably thinner than now. But, when at last the air becomes too light to sustain life, then will the earth be in her death throes, in the great tragedy, which must end the present beautiful and delightful place whereon we dwell, and leave the planet rolling through space a worthless corpse."

We see so much silly stuff as the above, going the rounds of the press, unchallenged, and purporting to come from astronomers, that sometimes we wonder whether there are persons in the world who do not know that we have a God who is the Creator of the heaven and the earth. "When will the earth die—or will she ever die? This question is one that the astronomers are asking; but from what source will come their answer? Yet it is proven by nature that all things which have life must have been born, and all things which have been born must die sooner or later."

In the sense in which the above questions are asked, the earth will never die. The very first statement is false in toto. The earth was not born, but created. "In the beginning God created the heaven and the earth."—Gen. 1:1. Then the earth, not having been born, she shall never die. "But from what source will come their answer?" The true answer must come from the never-dying source, **God's own word.** The earth shall be changed, transformed, purified and made over anew; **but she shall never die!** God's word for it. In Jer. 51:15 we read as follows: "He hath made the earth by His power, He hath established the world by His wisdom, and He hath stretched out the heaven by His understanding." 2d Peter 3:10—"But the day of the Lord will come as a thief in the night, in which the heavens shall pass away with a great noise, and the elements shall melt with fervent heat, and the earth also, and the works that are therein shall be burned up." Eccles. 1:4: "One generation passeth away, and another generation cometh: but the earth abideth forever." And John, the Revelator, says: "I saw a new heaven and a new earth; for the first heaven and the first earth had passed away." As a reminder, of the **wisdom** of **astronomers,** we only have to refer to what God said to Job in order that he might perceive the insignificance of his wisdom. Job 1:4, 7, 31:—(1), "Then the Lord answered Job out of the whirlwind, and said, (4) Where wast thou when I laid the foundations of the earth? Declare if thou hast understanding. (7) (And where wast thou) When the morning stars sang together, and all the sons of God shouted for joy? (31) Canst thou bind the sweet influences of Pleiades, or loose the bands of Orion?" By this criticism from God to Job for his presumptious wisdom, astronomers

certainly can feel their littleness. Astronomers have figured out that the earth may be anywhere from ten to five hundred million years old. It seems to us that there is a great gap between ten and five hundred millions. If astronomers are that far apart, the presumption is they know nothing whatever concerning the age of the earth. Astronomers also tell us that the water is "drying up" on the earth and that it will be a lifeless globe in fifteen million years; and that the air is also losing some of its power to sustain life. They also tell us that these changes are going on so slowly that they are imperceptible. Now, what we wish to know is this: If these changes are so slow that we have not been able to notice them at all for 6,000 years, or since we have known the earth, when can we notice them? If they are not perceptible to us, how do we know they are actually taking place? They must be in a "potential" state also: existing in "possibility," not in "actuality"—that is, have no existence at all. This is the sensible conclusion. But we have still better and more trustworthy proof from the Creator himself, that the earth is not losing any of its water or air, and here it is in His own words: Gen. 8:22—"While the earth remaineth, seed time and harvest, and cold and heat and summer and winter and day and night shall not cease." No; the earth will never die and become "a rolling ball through space, a worthless corpse." But she will have an end in exactly the way and manner pointed out by the Creator himself. It is liable to occur at any time. The sun is to be darkened as "black as sackcloth of hair," and the moon is to become "like blood," and there is to be an **earthquake** greater by far than any that has ever shaken the earth, and our old earth is to roll away and the stars shall fall, and continents and islands and rivers and oceans shall be moved out of their places; and the old earth will become rejuvenated, transformed and crystallized—made a beautiful paradise for the redeemed souls of those who came up through much tribulation. And God, the Creator, will sit in His chariot of fire and grind the mountains to dust and roll in awful grandeur above the stars. No; the earth will never die; but live on through the ages of eternity.

DEATH.

"There is no death!
What seems so is transition;
This life of mortal breath,
Is but a suburb of the life elysian,
Whose portal we call death."

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